

MUSSEF 1.5



*EPA Region X*  
**START**

Superfund Technical Assessment and Response Team

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*Musick Mine  
Preliminary Assessment/Site Inspection  
Sampling and Quality Assurance Plan*

**TDD: 03-11-0003-B**

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*EPA Contract: 68-S0-01-02*

*October 2004*

USEPA SF



1213798



*Weston Solutions, Inc. • 190 Queen Anne Avenue North • Seattle, WA 98109-4926*



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
**REGION 10**  
1200 Sixth Avenue  
Seattle, Washington 98101

September 23, 2004

Reply To  
Attn. Of: **OEA-095**

**MEMORANDUM**

**SUBJECT:** Review of Musick Mine Preliminary Assessment/Site Investigation Sampling and Quality Assurance Plan, Weston Solutions Inc, September, 2004

**FROM:** Donald Matheny, Senior Chemist *DM*  
Technical Support Unit, Office of Environmental Assessment

**TO:** Joanne LaBaw, Task Monitor  
Office of Environmental Cleanup

I've completed a review of the above Plan. No significant discrepancies were found and approval is recommended. If you have any questions, please call me at 553-2599.

MUSSF

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# SAMPLING AND QUALITY ASSURANCE PLAN

Musick Mine Preliminary Assessment/Site Inspection  
Lane County, Oregon

TDD: 03-11-0003

Submitted To:

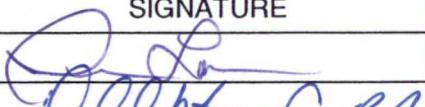

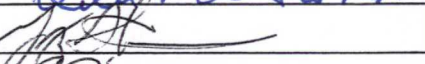
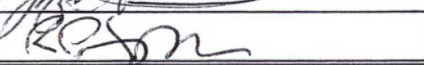
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October 2004

Contract No.: 68-S0-01-02  
Weston Work Order No.: 12644-001-002-0153-00  
Weston Document Control No.: 12644-001-002-AAWH

APPROVALS			
TITLE	NAME	SIGNATURE	DATE
EPA Task Monitor	Joanne Labaw		10/12/04
EPA QA Manager	Roy Araki		10/12/04
START Project Manager	Greg Stuesse		10/6/04
START QA Officer	Paul Swift		10/06/04

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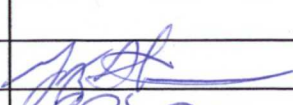

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**SQAP DISTRIBUTION LIST**

Name	Organization and Title	Draft SQAP	Final SQAP
Joanne Labaw	EPA Task Monitor	X	X
Roy Araki	EPA QA Manager	X	
Laura Castrilli	EPA Regional Sample Control Coordinator		X
Mary Camarata	ODEQ Site Assessment Program	X	X
Tamra Biasco	START Site Leader	X	X
Greg Stuesse	START Project Manager		X
Paul Swift	START QA Officer		X

**DATA DISTRIBUTION LIST**

Name	Title	Unvalidated Data		Validated Data	
		Hard Copy	Electronic Copy	Hard Copy	Electronic Copy
Joanne Labaw	EPA Task Monitor			X	X
START TDD File	File			X	X
Paul Swift	START QA Officer	X	X		
Tamra Biasco	START Site Leader			X	

**LIST OF ACRONYMS**

<u>Acronym</u>	<u>Definition</u>
AMD	Acid Mine Drainage
ARD	Acid Rock Drainage
cfs	cubic feet per second
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CLPAS	Contract Laboratory Program Analytical Service
CRQL	Contract Required Quantitation Limit
°C	degrees Celsius
DGPS	Differential Global Positioning System
DOT	Department of Transportation
Dup	Duplicate
DQI	Data Quality Indicators
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FOWP	Field Operations Work Plan
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	High Density Polyethylene
HRS	Hazard Ranking System
ICP	Inductively Coupled Plasma
IATA	International Air Transportation Association
ID	Identification
IDW	Investigation Derived Waste
ILM	Inorganic Laboratory Methods
L	Liter



**LIST OF ACRONYMS** *(Continued)*

<u>Acronym</u>	<u>Definition</u>
LCS	laboratory control sample
MEL	Manchester Environmental Laboratory
MS	matrix spike
msl	mean sea level
NA	Not Applicable
NRCS	Natural Resource Conservation Service
Noncritical	For informational purposes only or needed to provide background information
NPL	National Priorities List
NWI	National Wetland Inventory
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODGMI	Oregon Department of Geology and Mineral Industries
ONHIC	Oregon Natural Heritage Information Center
OWRD	Oregon Water Resources Department
oz	ounce
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyls
PE	performance evaluation
PM	Project Manager
PPE	probable point of entry
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QMP	Quality Management Plan
RPD	relative percent difference
RSCC	Regional Sample Control Coordinator
SI	Site Inspection

**LIST OF ACRONYMS** *(Continued)*

<u>Acronym</u>	<u>Definition</u>
SOPs	Standard operating procedures
SOW	Statement of Work
SQAP	Sampling and Quality Assurance Plan
START	Superfund Technical Assessment and Response Team
SW	EPA Office of Solid Waste and Emergency Response
TAL	Target Analyte List
TDD	Technical Direction Document
TDL	Target Distance Limit
TM	Task Monitor
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
Weston	Weston Solutions, Inc.
WRCC	Western Regional Climate Center
XRF	X-Ray Fluorescence

## SECTION 1

### PROJECT MANAGEMENT

#### 1.1 PROJECT/TASK ORGANIZATION

##### 1.1.1 Purpose

Pursuant to U.S. Environmental Protection Agency (EPA) Superfund Technical Assessment and Response Team (START) Contract No. 68-S0-01-02 and Technical Direction Document (TDD) No. 03-11-0003, Weston Solutions, Inc. (Weston) will perform a Preliminary Assessment/Site Inspection (PA/SI) at the Musick Mine, located in Lane County, Oregon. The PA/SI will consist of limited sampling at potential contaminant source(s), target areas, background locations, and attribution locations for site characterization purposes. This document outlines the technical and analytical approaches Weston will employ during PA/SI fieldwork.

This document is a combined Field Operations Work Plan (FOWP) and site-specific Quality Assurance Project Plan (QAPP) for field sampling activities. The combined FOWP/QAPP, hereafter called the Sampling and Quality Assurance Plan (SQAP), includes a brief site summary, project objectives, sampling and analytical procedures, and Quality Assurance (QA) requirements that will be used to obtain valid, representative field samples and measurements. The SQAP is intended to be combined with information presented in Weston's Quality Management Plan (QMP; Weston 2002) for Region 10 START. Copies of the QMP and the site-specific Health and Safety Plan are available in Weston's office located at 190 Queen Anne Avenue North, Suite 200, Seattle, Washington 98109-4926.

##### 1.1.2 Roles and Responsibilities

This section lists the individuals directly involved with the Musick Mine PA/SI and their specific responsibilities. Lines of communication are shown in the Project Organization Chart (Figure 1-1). Work performed under this SQAP will be in cooperation with Oregon Department of Environmental Quality (ODEQ) to assist the EPA site assessment program. Below is a discussion of the project personnel involved and their role in the project.

###### *1.1.2.1 EPA Region 10 Task Monitor (TM)*

The EPA TM for this project is Joanne Labaw. Ms. Labaw is the overall project coordinator, decision maker, primary point of contact for general project problem resolution, and has approving authority for the project. She will review and approve the site-specific SQAP and subsequent revisions in terms of project scope, objectives, and schedules. She will also ensure that the site-specific SQAP is properly implemented.

###### *1.1.2.2 EPA Region QA Manager*

The EPA Region 10 QA Manager is Roy Araki. Mr. Araki or designee reviews and approves the site-specific SQAP and revisions. The QA Manager may also conduct assessments of field



activities, and has the authority to stop work at the site if he believes that QA protocols are not followed properly.

#### *1.1.2.3 EPA Region 10 Regional Sample Control Coordinator (RSCC)*

The EPA Region 10 RSCC is Laura Castrilli. Ms. Castrilli coordinates sample analyses performed through the EPA Contract Laboratory Program (CLP) and/or the EPA Region 10 Manchester Environmental Laboratory (MEL) and provides sample identification numbers.

#### *1.1.2.4 Weston START Project Manager (PM)*

The Weston START PM is Greg Stuesse. Mr. Stuesse has the responsibility for the overall performance of the START team. He will review and approve the site-specific SQAP. He makes the ultimate decisions for the implementation of START projects and ensures that the implementation of the project is performed in accordance with the specifications of the SQAP and Weston's QMP and SOPs. Mr. Stuesse has overall responsibility for maintaining project budget and schedule. In the absence of the START PM, the START Site Leader will assume the PM's responsibilities.

#### *1.1.2.5 Weston START Site Leader*

The Weston START Site Leader is Tamra Biasco. Ms. Biasco is the primary contact point with the EPA TM, provides overall coordination of fieldwork, and oversees the preparation of the site-specific SQAP. She will ensure that the final, approved version of the site-specific SQAP is implemented correctly and will record any deviations from this plan. Ms. Biasco will receive the CLP/Region 10 laboratory information from the RSCC and is the primary START point of contact for technical problems. She will be responsible for the execution of decisions and courses of action deemed appropriate by the EPA TM.

#### *1.1.2.6 Weston START QA Officer*

The Weston START QA Officer is Paul Swift. Dr. Swift will review and approve the site-specific SQAP, will conduct in-house audits of field operations, and will be responsible for auditing and reviewing the field activities, deliverables, and if necessary, for approving corrective actions for nonconformities. Dr. Swift has the authority to stop work at the site if he believes that QA protocols are not followed properly.

#### *1.1.2.7 Weston START Program Manager and EPA Project Officer*

The Weston START Program Manager, Mr. Kevin Connolly, and the EPA Project Officer, Ms. Sharon Nickels, are responsible for coordinating resources requested by the EPA TM for the overall execution of the START program.

## **1.2 PROBLEM DEFINITION/BACKGROUND**

This section discusses the site background (Section 1.2.1), site operations and source characteristics (Section 1.2.2), and site characterization (Section 1.2.3).



### 1.2.1 Site Background

Information presented in this section is based on a review of site background information, including a PA of the site performed by ODEQ (ODEQ 2003a, b), and interviews with property owners and representatives from various regulatory agencies, and aerial photographs (WAC 1987, 1986).

#### 1.2.1.1 Site Location

Site Name:	Musick Mine—CERCLA ID No.: ORN001002521
Location:	The mines are located within the Umpqua National Forest approximately 35 miles southeast of Cottage Grove, Oregon; no physical address is available.
Latitude/Longitude:	43°34'42"N/122°39'10"W
Legal Description:	Sections 14 & 15, Township 23S, Range 1E
County:	Lane County, Oregon
Site Owner:	Musick Mining Co-op Inc. 115 Hansen Lane Eugene, Oregon 97404
Site Contact:	Gale Hulihan, Representative for Musick Mine (541) 689-8902

#### 1.2.1.2 Site Description

The Musick Mine is an inactive gold and silver mine located approximately 35 miles southeast of Cottage Grove, Oregon (Figure 1-2). The Musick Mine is located within the Bohemia Mining District at elevations ranging from 4,300 feet to 5,400 feet above mean sea level (msl). The areas surrounding the site are part of the Umpqua National Forest managed by the United States Forest Service (USFS). The area is primarily used for silviculture and recreational purposes such as hiking and camping.

The Musick Mine consists of the Upper Music Mine located on the southeast side of the Bohemia saddle, and the Lower Musick Mine located on the northwest side of the Bohemia saddle. According to ODEQ, the Lower Musick Mine is mislabeled as the Vesuvius Mine on United States Geological Survey (USGS) topographic maps (ODEQ 2003b). The Upper and Lower Musick Mine are located on separate drainage channels, consist of separate veins, and have separate adits.

#### 1.2.1.3 Site Ownership History

The Musick Mine was established in 1891. Between 1891 to present date, several individuals have privately owned and operated the mine at different time periods. Musick Mine occupies

approximately 160 acres and is currently owned by the Musick Mining Co-op Inc (Lane County Tax Assessor 2003). The Musick Mine consists of 13 patented and three unpatented mining claims including the Alpharette, Nina, Los Angeles, White Ghost, California, Defiance, Idaho, June, Hazel, Cluckey Fraction, Ophir, Rattler, and Arlington (Callaghan 1938; Lane County Tax Assessor 2003). Figure 1-3 illustrates the overall boundary of the Musick Mine based on a compilation of the above mentioned claim boundaries.

### 1.2.2 Site Operations and Source Characteristics

In 1891, Musick Mine was established and a 5-ton stamp mill was constructed, receiving ore from 1891 to 1901 (Callaghan 1938; Oregon Department of Geology and Mineral Industries [ODGMI] 1951). From 1902 to 1907, mining continued but the ore was transported to the Champion Mine mill for processing (Taber 1949). The ore was transported by electric tram or locomotive to the Even Star adit located on the Champion Mine property (Taber 1949). In 1935, the Musick Mine 5-ton stamp mill was replaced with a 22-ton gravity concentration mill allowing for concentrate processing on the Musick Mine property. The 22-ton mill produced concentrates until 1937 when mining operations were shut down. The mine remains inactive today.

When the mine was active, ore was removed from the mineshaft and transported to the stamp mill for gold and silver extraction. Ore was transported by electric tram from the adits to a 50-ton coarse ore bin by the mill where the ore was crushed in the milling process to a fine powder. When the 22-ton mill was established in 1935, the powder was processed to a concentrate using gravity concentration method of extraction.

Gravity concentration separates minerals based on differences in their density. The size of the particles being separated is important, thus sizes are kept uniform with classifiers (such as screens and hydrocyclones). Gravity concentration involves passing a slurry of ore and water over a series of riffles (ridged tables that vibrate and separate the gold) to catch heavier gold particles (EPA 1995). Amalgamation, or wetting metallic gold with mercury to form an amalgam, is another recovery technique commonly used by gravity concentration mills. Target Analyte List (TAL) metals are contaminants of concern associated with the gravity concentration mill.

Acid drainage is also a potential hazard associated with the mine. Acid drainage occurs when pyrite and other sulfide minerals, upon exposure to oxygen and water, oxidize to create ferric ions and sulfuric acid. Catalyzed by bacteria, the ferrous ions react further with oxygen, producing hydrated iron oxide, known as "yellowboy" (EPA 1995). This combination of yellowboy and sulfuric acid may contaminate surrounding soil, groundwater, and surface water, producing water with a low pH. When this reaction occurs within a mine it is called Acid Mine Drainage (AMD). When it occurs in waste rock and tailings piles it is often known as Acid Rock Drainage (ARD), although AMD is the most widely used term for both (EPA 1995). Acid drainage can lower the pH of surrounding water, making it corrosive and unable to support many forms of aquatic life; vegetation growing along streams can also be affected. Mine water can also carry toxic, metal-bearing sediment into streams, which can adversely affect waterborne plant



and animal species. Abandoned mines can produce acid drainage for over 50 years (EPA 1995). AMD is a contaminant of concern associated with the surface water flowing from the adits.

Polychlorinated biphenyls (PCBs) are also a potential hazard associated with the mine. PCBs came into use in the U.S. in the early 1930's. The 22-ton mill was in operation from 1935 to 1937 and the ODEQ Site Assessment Action noted the possible presence of PCBs associated with electrical transformers (ODEQ 2003a). PCBs remain persistent on soils and sediments, therefore are considered a contaminant of concern.

Waste discharge consisted of tailings and water that was pumped over the riffles. Contaminants of concern at the site include TAL metals, pH, and potentially PCBs at the 22-ton mill.

### 1.2.3 Site Characterization

This section summarizes previous site investigations (Section 1.2.3.1), discusses migration/exposure pathways and targets (Section 1.2.3.2), and describes areas of potential contamination (Section 1.2.3.3).

#### 1.2.3.1 Previous Site Investigations

In June 2003, ODEQ conducted a site assessment from an adjacent property since property access was not granted to Musick Mine. A literature review was conducted as part of ODEQ's assessment. When the site was last inventoried in 1949 there was a tunnel house, a metal covered mill building, a 50-ton capacity ore bin, four dwelling houses, a mill, and a bunkhouse/cookhouse for 30 men located on the east slope of the Bohemia Saddle (Taber 1949).

#### 1.2.3.2 Migration/Exposure Pathways and Targets

This section discusses the groundwater migration pathway, surface water migration pathway, soil exposure, and the air migration pathway, and potential targets within the site's range of influence (Figures 1-4 and 1-5). Data gaps and assumptions will be investigated during the site visit and documented in the final PA/SI report.

##### 1.2.3.2.1 Groundwater Migration Pathway

The site is located within the Umpqua National Forest along the Calapooya Divide within the Calapooya Mountains of Oregon. The main mine workings are located on the east slope of the Bohemia Saddle between Bohemia Mountain and Fairview Peak. The Calapooya divide is rugged, with steep, narrow valleys and peaks 5,900 feet above msl. Geology at the Musick Mine consists of Miocene and Oligocene sedimentary and volcanoclastic rocks (Portland State University [PSU] 2004). Based on the subsurface geology in the area, Weston assumed a hydraulic conductivity of  $10^{-5}$  centimeter per second (cm/sec).

According to the Oregon Water Resource Department (OWRD) there are no groundwater wells located within the 4-mile target distance limit (TDL; OWRD 2003). Depth to groundwater near the site is unknown since there are no wells located near the site and there are no records of a groundwater study in the area. The mean annual precipitation is 55.3 inches recorded at the



Disston, Oregon station, located approximately 12 miles northwest of the mine (Western Regional Climate Center [WRCC] 2003). Depth to contamination in the site vicinity, if present, is unknown. The 4-mile TDL for the groundwater pathway is presented in Figure 1-4.

#### 1.2.3.2.2 Surface Water Migration Pathway

The Upper Musick Mine and Lower Musick Mine have separate surface water drainage pathways. The Upper Musick Mine is located on the southeast side of the Bohemia saddle and drains south-southeast into the headwaters of City Creek. The Lower Musick Mine is located on the northwest side of the Bohemia saddle and drains west into Glenwood Creek. Based on the location of the adits shown on the topographic map (USGS 1986), the Upper Musick Mine is assumed to have two probable points of entry (PPE 1 and PPE 2) and the Lower Musick Mine is assumed to have one PPE (PPE 3), as shown on Figures 1-3 and 1-5.

The 15-mile TDL for PPE 1 from the Upper Musick Mine begins at the PPE into City Creek. City Creek flows approximately 7 miles to the confluence with Steamboat Creek. The 15-mile TDL continues 8 miles along Steamboat Creek to the end of the 15 mile TDL. The 15-mile TDL for PPE 2 begins at the PPE into an unnamed tributary to City Creek and flow approximately ½ mile to the confluence with City Creek. The 15-mile TDL flows approximately 7 miles in City Creek to the confluence with Steamboat Creek and then continues along Steamboat Creek 8¼ miles to the end of the 15-mile TDL. The flow rate for the City Creek has been recorded as 0.71 cubic feet per second (cfs) during September (Rinella 1996). Flow rates in the 2002 water year for Steamboat Creek have been reported to range from 28 cfs to 12,700 cfs with an annual mean of 664 cfs (USGS 2003). Based on the flow rates, City Creek is considered a minimal stream and the Steamboat Creek is considered a large stream to river (EPA 1990).

The 15-mile TDL for the Lower Musick Mine begins at the PPE into Glenwood Creek (PPE 3). Glenwood Creek flows approximately 1¼ miles west to its confluence with Bohemia Creek. The 15-mile TDL continues approximately ½ mile along Bohemia Creek to its confluence with the Sharps Creek and an additional 13 ¼ miles along the Sharps Creek to the end of the 15 mile TDL. The flow rate for Glenwood Creek and Bohemia Creek are estimated to be less than 10 cfs. The flow rate for Sharps Creek is estimate to range between 100 cfs to 1,000 cfs. Based on their flow rates, Glenwood and Bohemia Creek are considered minimal streams and Sharps Creek is considered a moderate to large stream (EPA 1990).

The Musick Mine site is located within the boundaries of the Umpqua National Forest. Surface soil type in the vicinity of the Musick Mine has not been investigated or mapped by the Natural Resource Conservation Service (NRCS) or USFS. The soils will be characterized during the site visit. The 2-year, 24-hour rainfall is 4.67 inches recorded at the Disston, Oregon station, located approximately 12 miles northwest of the mine (WRCC 2003). The estimated upland drainage area for the site is approximately 40 acres on the east slope of the Bohemia saddle and 20 acres on the west slope. The mine is not located in a floodplain (Federal Emergency Management Agency [FEMA] 2003).

There are no surface water intakes located along the 15-mile TDL for the Upper or Lower Musick Mine (OWRD 2003). The 15-mile TDL surface water pathway for the Upper and Lower Musick Mine is illustrated in Figure 1-5. City Creek and Steamboat Creek are closed to angling



and not used for recreational or commercial fishing (Oregon Department of Fish and Wildlife [ODFW] 2004). Cutthroat trout and steelhead salmon utilize Steamboat Creek and City Creek for rearing and spawning habitat (ODFW 2004). Glenwood, Bohemia, and Sharps Creeks are open to angling but no fish catch data is available for these creeks (ODFW 2004). Cutthroat trout utilize Glenwood, Bohemia, and Sharps Creeks for rearing and spawning habitat (ODFW 2004).

Several sensitive environments are present along the 15-mile downstream TDL of the site (Oregon Natural Heritage Information Center [ONHIC] 2004).

- The cutthroat trout (*Onchorynchus clarki*), a federal-listed endangered species, utilizes the 15-mile surface water pathway as spawning and rearing habitat.
- The American peregrine falcon (*Falco peregrinus anatum*), a state-listed endangered species, is present within the 15-mile TDL of the site.
- The northern spotted owl (*Strix occidentalis caurina*), a federal-and state-listed threatened species, is present within the 15-mile TDL of the site.

Wetland frontage along the 15-mile TDL to the north (Lower Musick) is approximately ¼ mile of Paulstrine wetland frontage along Sharps Creek (United States Fish and Wildlife Service [USFWS] 1993b, c, d). There are no Hazard Ranking System (HRS) designated wetlands located along Glenwood Creek or along Bohemia Creek (USFWS 1993c). Wetland frontage along the 15-mile TDL to the south (Upper Musick) is approximately 1 mile of Paulstrine wetland frontage along Steamboat Creek (USFWS 1995, 1993a, c). There are no HRS designated wetlands located along City Creek (USFWS 1993a, c). Neither surface water 15-mile TDL is currently used to irrigate commercial food crops, water commercial livestock, commercial food preparation, or to supply a major designated water recreation area (OWRD 2003).

#### 1.2.3.2.3 Soil Exposure Pathway

There are no residences or workers known to be located on the Musick Mine site or within 200 feet of potential sources of contamination. No schools or daycare facilities are located within 200 feet of the site. There are no regularly-occupied residences, schools, or places of employment within 4 miles of the site. No terrestrial sensitive environments are known to occur on areas of potential contamination. No commercial agriculture, commercial livestock production or grazing are expected to occur onsite. The site is accessible to the public and is likely used for recreational purposes.

#### 1.2.3.2.4 Air Migration Pathway

Since there are currently no air emissions at the site (the site has been inactive since 1937), the potential for release at the site stems mainly from the potential to release by particulate migration. No known air releases have occurred from the site. No complaints have been filed regarding emissions at the property during periods of activity. There is no recorded population within 4 miles of the site and no workers are currently present at the site.

Based on National Wetland Inventory (NWI) maps, Weston estimates that approximately 19 acres of wetlands occurs within a 4-mile radius of the site (USFWS 1993a, c, e, f). Several sensitive environments are present within the 4-mile TDL of the site (ONHIC 2004).

- The cutthroat trout (*Onchorynchus clarki*), a federal-listed endangered species, utilizes the 15-mile surface water pathway as spawning and rearing habitat.
- The American peregrine falcon (*Falco peregrinus anatum*), a state-listed endangered species, is present within the 15-mile TDL of the site.
- The northern spotted owl (*Strix occidentalis caurina*), a federal-and state-listed threatened species, is present within the 15-mile TDL of the site.

There are no commercial agriculture or major or designated recreation areas within 1/2 mile of the site.

#### 1.2.3.3 Areas of Potential Contamination

The PA/SI will include sampling of potential contamination source areas and of areas that may have been contaminated by the migration of hazardous substances from sources on the site. Based on the available information, the areas or features identified for inspection during the Musick Mine PA/SI are outlined below.

##### 1.2.3.3.1 Upper Musick Potential Sources

- *Adit Drainage*—As shown on the topographic map of the area (USGS 1986), two adits with potential AMD are expected to exist. Potential contaminants of concern include TAL metals, mercury, and elevated surface water pH associated with AMD.
- *Tailings Piles*—Two tailings piles are expected to exist onsite, as there was an operational mill and based on visual observation by ODEQ. Potential contaminants of concern include TAL metals and mercury.
- *Waste Rock Pile*—At least one waste rock pile is expected to be located onsite due to past mining operations. Potential contaminants of concern include TAL metals and mercury.
- *22-Ton Mill*—Records indicate that a 22-ton gravity concentration mill replaced the 5-ton stamp mill. Potential contaminants of concern include TAL metals, mercury, and PCBs.
- *50-Ton Coarse Ore Bin*—One large coarse fraction ore bin is recorded to have been onsite. Potential contaminants of concern include TAL metals and mercury.

##### 1.2.3.3.2 Lower Musick Potential Sources

- *Adit Drainage*—As shown on the topographic map of the area (USGS 1986), at least one adit with potential AMD is expected to exist. Potential contaminants of concern include TAL metals, mercury, and elevated surface water pH associated with AMD.
- *Tailings Pile*—At least one tailings pile is expected to exist onsite based on ODEQ visual observation. Potential contaminants of concern include TAL metals and mercury.



- *Waste Rock Piles*—At least one waste rock pile is expected to exist due to past mining operations. Potential contaminants of concern include TAL metals and mercury.

#### 1.2.3.3.3 Potential Targets

*Stream Sediment*—The release of contaminants to the surface water pathway may have impacted sediment quality in the streams at and downgradient of the mine. Acid drainage can lower the pH of surrounding water, making it corrosive and unable to support many forms of aquatic life; vegetation growing along streams can also be affected. Mine water can also carry toxic, metal-bearing sediment into streams, which can adversely affect waterborne plant and animal species.

*Sensitive Environments South of Upper Musick Mine*—Wetland frontage extends 1 mile along Steamboat Creek located approximately 8 miles downgradient of the Upper Musick Mine. City Creek and Steamboat Creek are potentially used by threatened and endangered species (ONHIC 2004) as discussed in Section 1.2.3.2.2.

*Sensitive Environments North of Lower Musick Mine*—Wetland frontage extends ¼ mile along Sharps Creek located approximately 6 ½ miles downgradient of the Lower Musick Mine. Glenwood, Bohemia, and Sharps Creeks are potentially used by threatened and endangered species (ONHIC 2004) as discussed in Section 1.2.3.2.2.

### 1.3 PROJECT/TASK DESCRIPTION AND SCHEDULE

This section provides the project description (Section 1.3.1) and proposed schedule (Section 1.3.2).

#### 1.3.1 Project Description

This section defines the objectives and scope for performing the PA/SI activities at the Musick Mine site. The main goals for the PA/SI activities are as follows:

- Collect and analyze samples to characterize the potential sources discussed in Section 1.2.3.3.
- Assess off-site migration of contaminants.
- Provide the EPA with adequate information to determine whether the site is eligible for further investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- Document a threat or potential threat to public health or the environment posed by the site.



### 1.3.2 Schedule

The Musick Mine proposed schedule of project work is as follows:

Activity	Start	Complete
Mobilize to Site	10/11/2004	10/11/2004
Sample Collection Activities	10/11/2004	10/14/2004
Laboratory Receipt of Samples	10/15/2004	10/16/2004
Demobilize from Site	10/15/2004	10/15/2004
Laboratory Analysis	10/18/2004	11/05/2004
Receipt of Data from Laboratory	11/08/2004	11/08/2004
Data Validation	11/08/2004	11/29/2004
Writing of Project Report	11/29/2004	12/29/2004
Target Project Completion Date	Not Applicable	1/15/2005

The schedule for implementing the Musick Mine PA/SI is intended to be used as a guide. Adjustments to the implementation dates and the estimated project duration may be necessary to account for variable unforeseen or unavoidable conditions that the field team may encounter. Examples include inclement weather, difficulties in accessing a sampling site, or additional time needed to complete a task. Significant schedule changes that arise in the field will be discussed with the TM at the earliest possible convenience.

## 1.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The project Data Quality Objectives (DQO) are to provide valid data of known and documented quality to characterize source(s), determine off-site migration of contaminants, determine whether the site is eligible for further investigation under CERCLA, and document threat(s) or potential threat(s) to public health or the environment posed by the site. The DQO process applied to this project followed that described in the EPA document, *Guidance for the Data Quality Objectives Process* (EPA 2000a).

### 1.4.1 DQO Data Categories

All samples collected under this SQAP will be analyzed using definitive analytical methods. All definitive analytical methods employed for this project will be methods approved by the EPA. The data generated under this project will comply with the requirements for this data category as defined in *Data Quality Objective Process for Superfund* (EPA 2000b).

### 1.4.2 Data Quality Indicators (DQIs)

Precision, accuracy, representativeness, comparability, and completeness goals are the DQIs for this project. They were developed following guidelines presented in the EPA *Guidance for Quality Assurance Project Plans* Appendix D (EPA 1998).

The basis for assessing each of the elements of data quality is discussed in the following subsections. Table 2-3 presents the QA objectives for measurement of analytical data and Quality Control (QC) guidelines for precision and accuracy. Other DQI goals are included in the individual Standard Operating Procedures (SOPs) in Appendix A.

#### 1.4.2.1 Representativeness

Representativeness is a measure of the degree to which data accurately and precisely represent a population, including a sampling point, a process condition, or an environmental condition. Representativeness is the qualitative term that should be evaluated to determine that measurements are made and physical samples collected at locations and in a manner resulting in characterizing a matrix or media. Subsequently, representativeness is used to ensure that a sampled population represents the target population and a sample aliquot represents a sampling unit. This SQAP will be implemented to establish representativeness for this project.

Further, all sampling procedures detailed in the SQAP will be followed to help ensure that the data will be representative of the media sampled. Additionally, the sampling design presented in the SQAP will ensure that there are a sufficient number of samples and level of confidence that analysis of these samples will detect the chemicals of concern, if present.

#### 1.4.2.2 Comparability

Comparability is the qualitative term that expresses the measure of confidence that two data sets or batches can contribute to a common analysis and evaluation. Comparability with respect to laboratory analyses pertains to method type comparison, holding times, stability issues, and aspects of overall analytical quantitation. The following items are evaluated when assessing data comparability:

- Determining if two data sets or batches contain the same set of parameters
- Determining if the units used for each data set are convertible to a common metric
- Determining if comparable analytical procedures and quality assurance were used to collect data for both data sets
- Determining if samples within data sets were selected and collected in a similar manner

To ensure comparability of data collected during this investigation to other data that may have been or may be collected for the site, standard collection and measurement techniques will be used.

#### 1.4.2.3 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not



rejected through data validation. The requirement for completeness is 95% for aqueous samples and 90% for soil/sediment samples. The following formula is used to calculate completeness:

$$\% \text{ completeness} = \frac{\text{number of valid results for samples analyzed}}{\text{number of possible results for all samples}} * 100$$

For this investigation, all samples are considered critical. Therefore, standard collection and measurement methods will be used to achieve the completeness goal.

#### 1.4.2.4 Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. *Analytical* precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The laboratory control sample (LCS) assesses the precision of the analytical method. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch. Rather, the comparison is between the sample and samples analyzed in previous batches.

*Total* precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and/or sample matrix/duplicate spiked samples shall be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results.

The following formula is used to calculate precision:

$$RPD = (100) \times \frac{|S_1 - S_2|}{(S_1 + S_2)/2}$$

where:

$S_1$  = normal sample value

$S_2$  = duplicate sample value

#### 1.4.2.5 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random uncertainty (variability due to imprecision) and systemic uncertainty. It reflects the total uncertainty associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard within a certain confidence level. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS or Matrix Spike (MS) sample to a control limit. Analysis of performance evaluation (PE) samples also may be used to provide additional information for assessing the accuracy of the analytical data being produced.



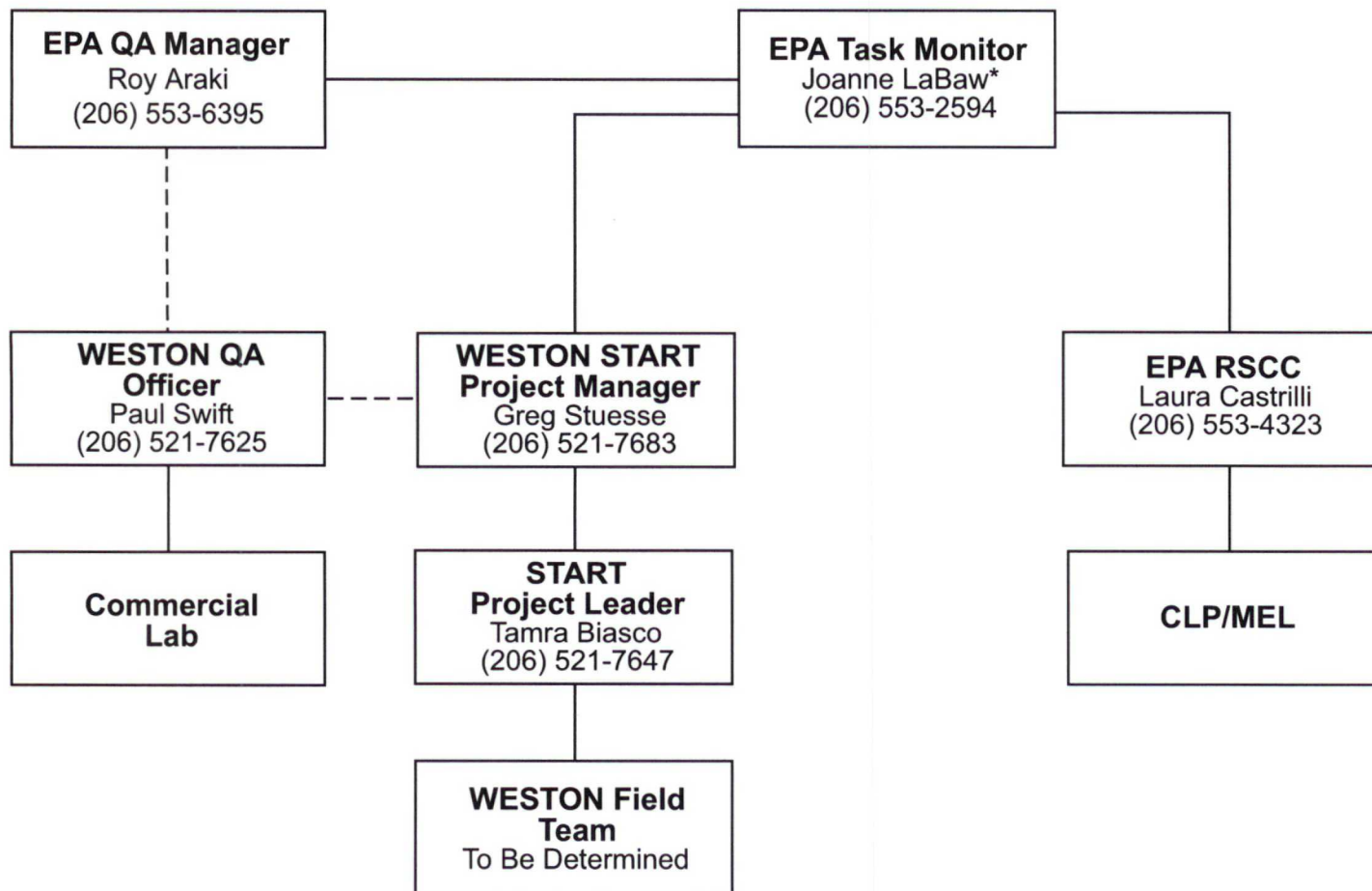
## 1.5 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

Special training requirements or certifications required for this project include the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) class and annual refreshers, and certification of training to use the x-ray fluorescence (XRF) spectrometer. Health and safety procedures for Weston personnel are addressed in the Weston site-specific health and safety plan. Copies of this document are maintained in Weston's Seattle office and at the project site. Included in the plan are descriptions of anticipated chemical and physical hazards, required levels of protection, health and safety monitoring requirements and action levels, personal decontamination procedures, and emergency procedures. All field personnel are required to read and comply with the plan.

## 1.6 DOCUMENTATION AND RECORDS

This document is meant to be combined with information presented in Weston's QMP for Region 10 START (Weston 2003). This information is covered by Section 2.3 of this SQAP (Sample Handling and Custody Requirements), the SOPs found in Appendix A, and the Supplemental Forms found in Appendix B. A copy of the START QMP is available in Weston's Seattle office. Standards contained in the SOPs and the QMP will be used to insure the validity of data generated by Weston for this project.

Following the completion of fieldwork and the receipt of analytical data, a report summarizing project findings will be prepared. Project files including work plans, reports, analytical data packages, correspondence, chain-of-custody documentation, original logbooks, corrective action forms, referenced materials, and photographs will be provided to the EPA TM at the close of the project, as needed.

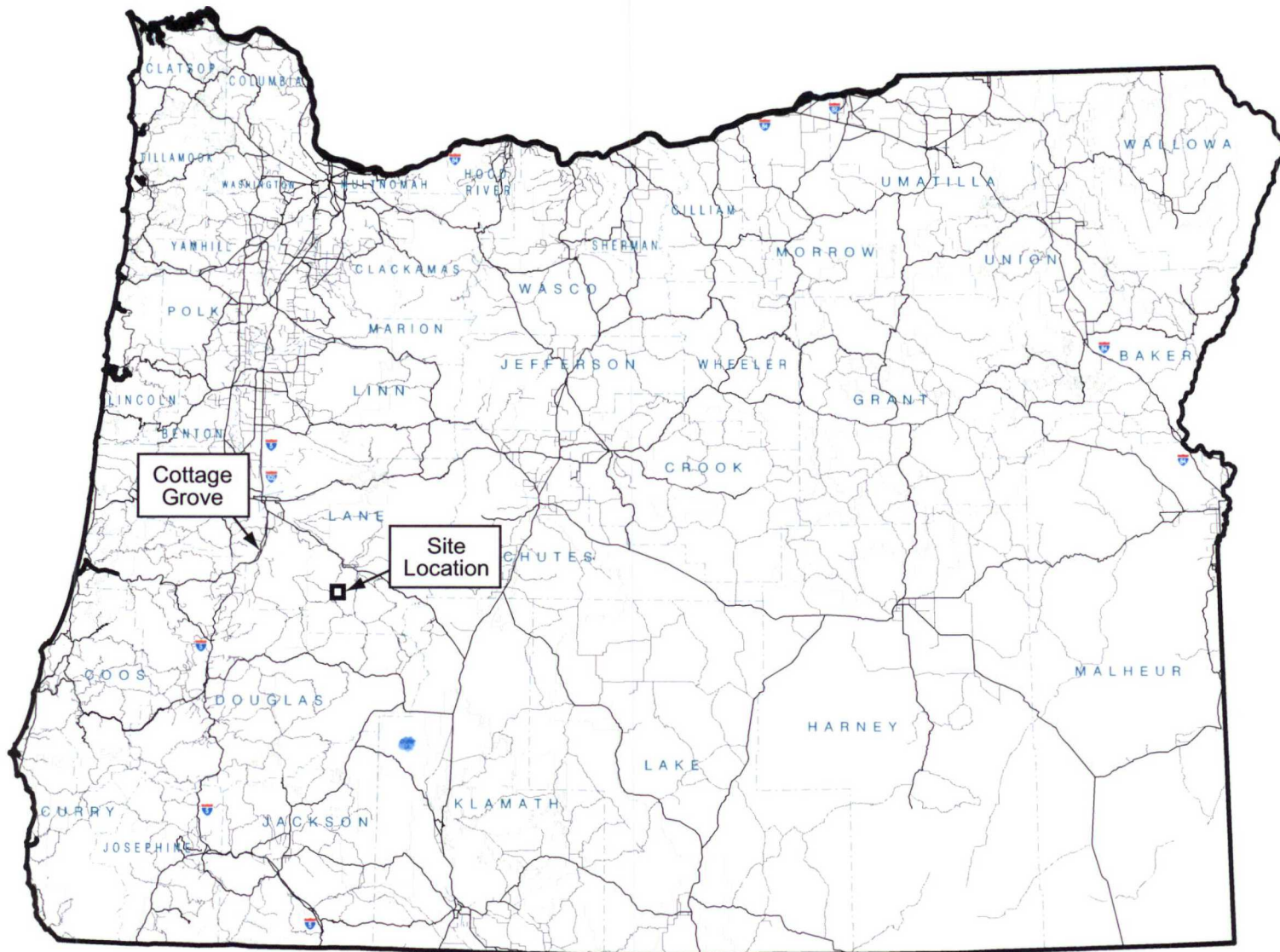


\* Approving Authority

Project Organization Chart  
Musick Mine PA/SI  
Lane County, Oregon



Figure  
**1-1**



Source: Oregon Department of Transportation, Geographic Information Services, 2001.

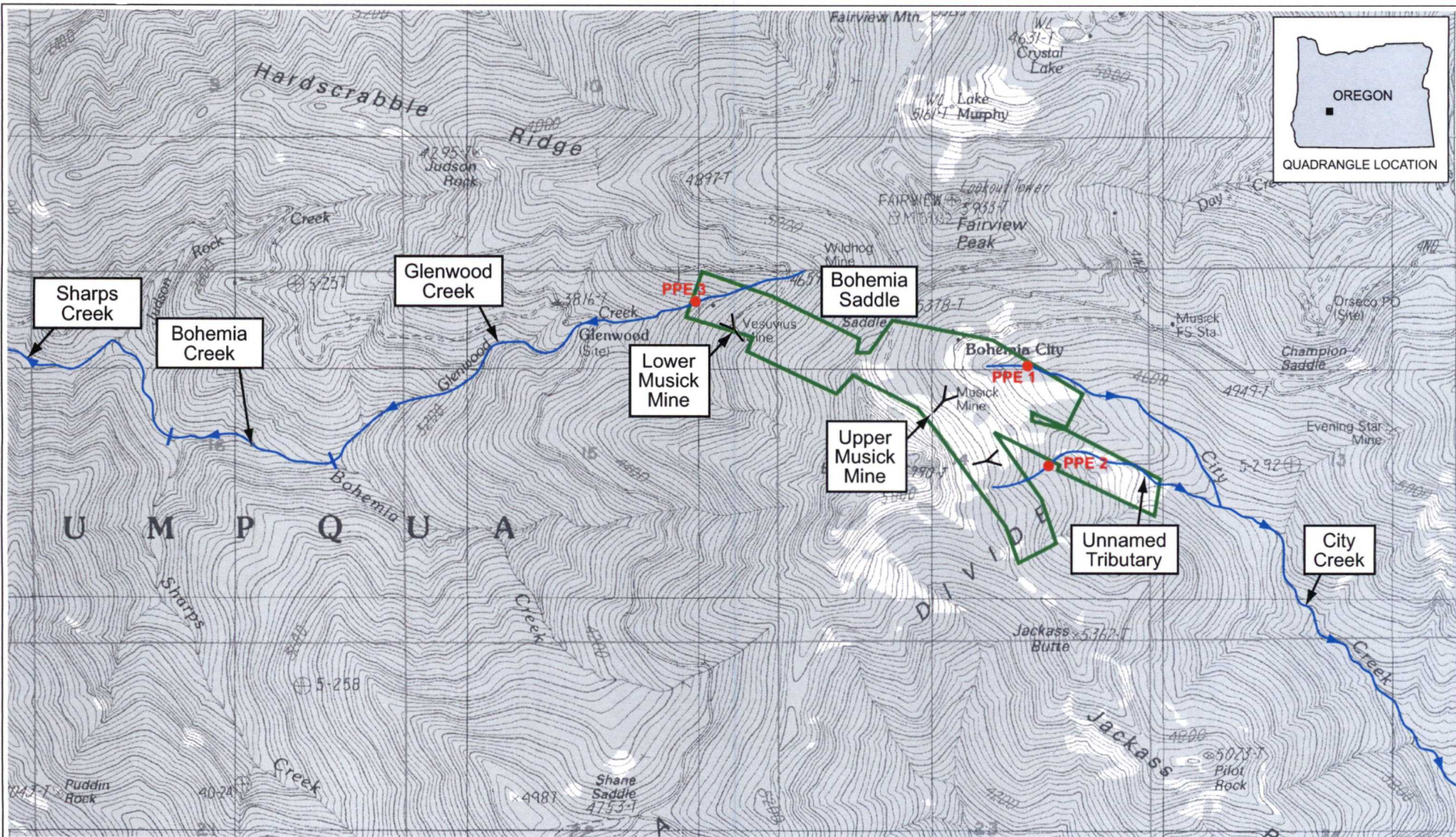


Site Location Map  
Musick Mine PA/SI  
Lane County, Oregon

Figure

1-2





Source: USGS 7.5' Series Topo, Fairview Peak-OR, 1986.



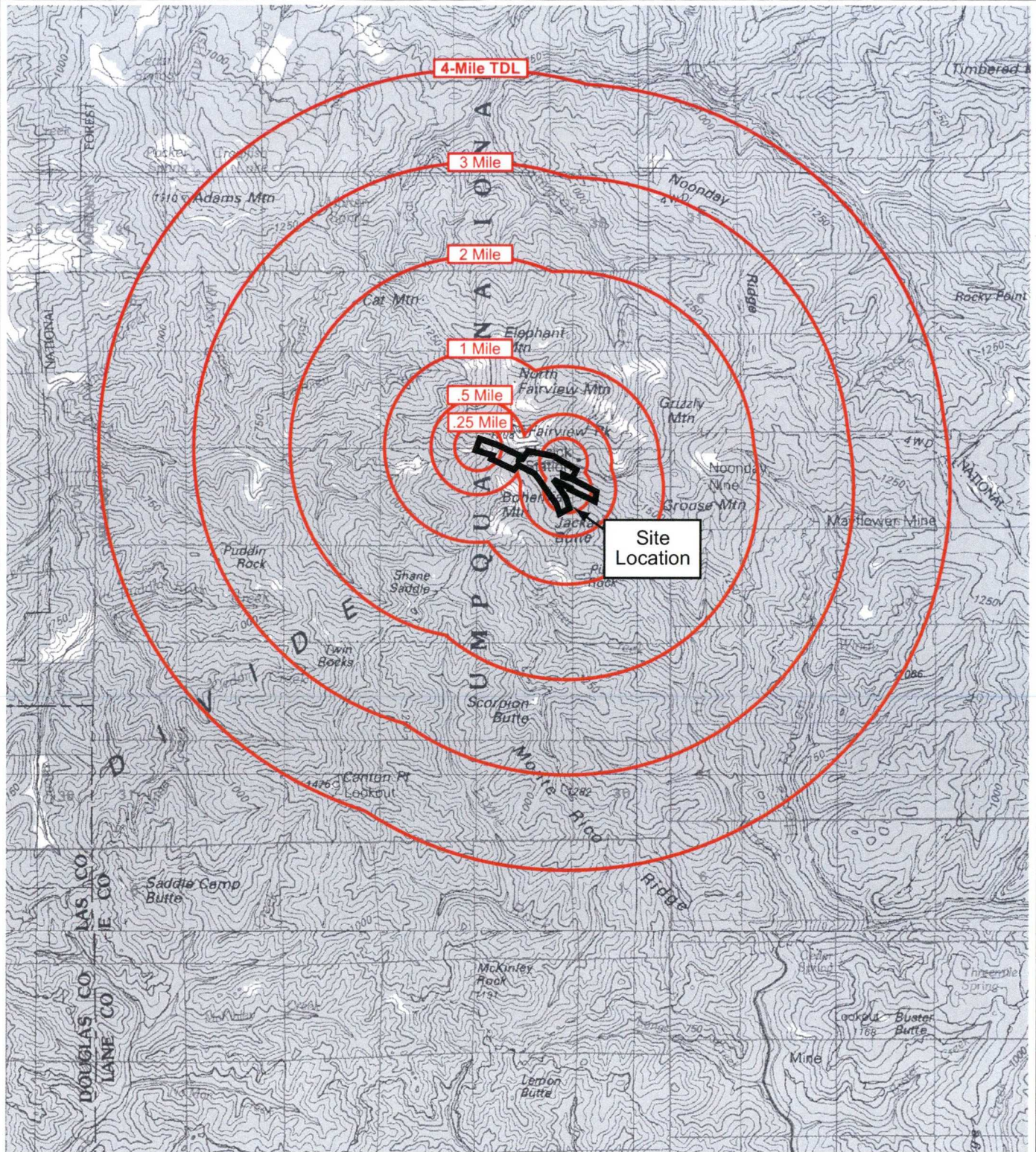
- Property Boundary
- Probable Point of Entry (PPE)
- Surface Water Flow Direction
- ⋈ Adit

# Site Diagram Musick Mine PA/SI Lane County, Oregon

Figure

1-3





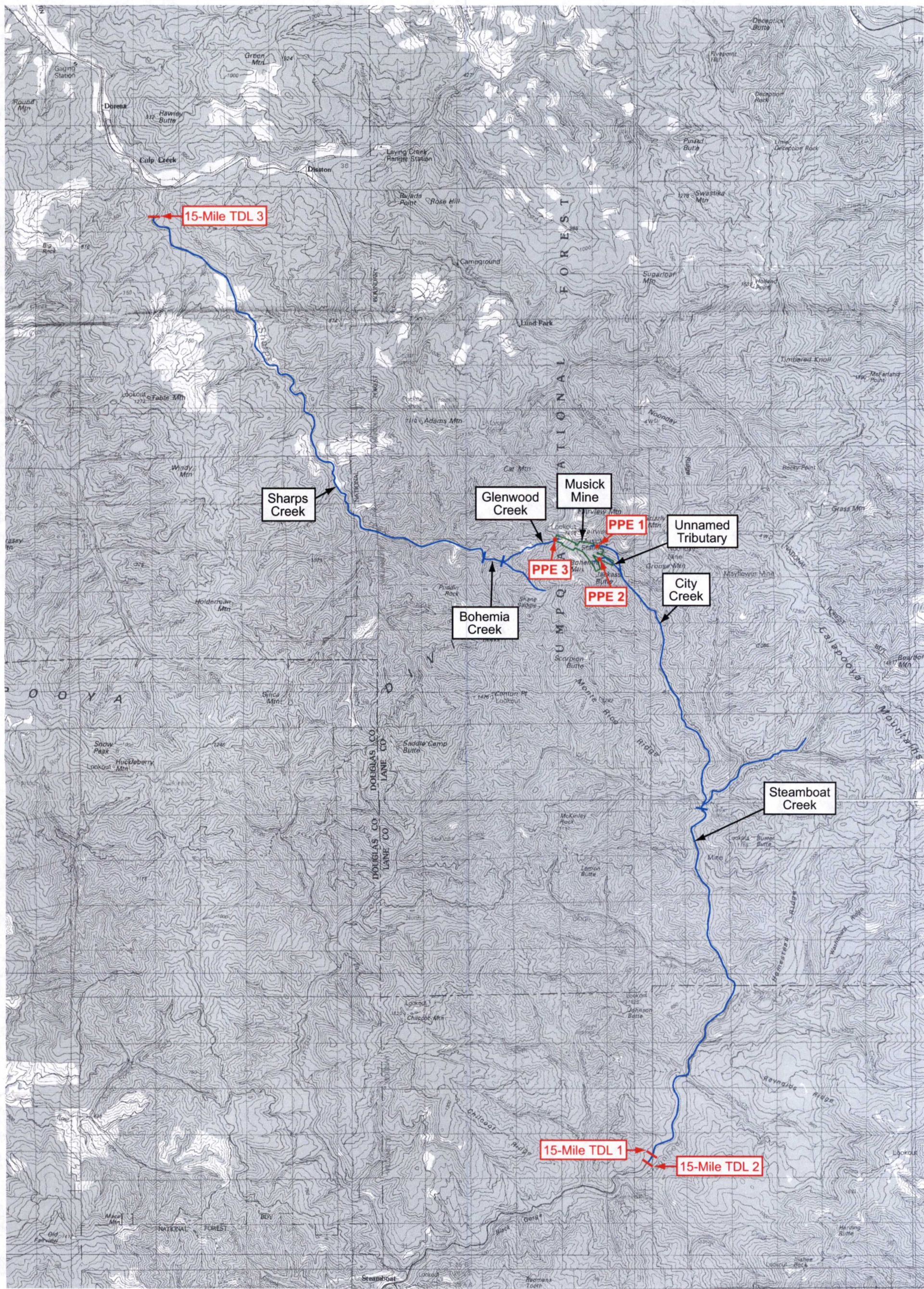
Source: USGS 1:100,000 Scale Series Topo, Diamond Lake-OR, 1978 and Oakridge-OR, 1983.



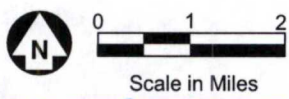
## 4-Mile Target Distance Limit (TDL) Map Musick Mine PA/SI Lane County, Oregon

Figure  
**1-4**





Source: USGS 1:100,000 Scale Series Topo, Diamond Lake-OR, 1978 and Oakridge-OR, 1983.



— Property Boundary

● Probable Point of Entry (PPE)

— Surface Water

## 15-Mile Target Distance Limit (TDL) Map

### Musick Mine PA/SI

### Lane County, Oregon

Figure  
**1-5**



## SECTION 2

### MEASUREMENT/DATA ACQUISITION

#### 2.1 SAMPLING PROCESS DESIGN

During the PA/SI, samples will be collected from locations or features considered potential contamination sources, from selected potential hazardous substance migration pathways, and from potential targets in those pathways. The locations to be sampled have been determined based on information derived from a review of background information, interviews with persons familiar with the site, and will be further determined during the site visit. Table 2-1 provides sample information regarding the sampling design and whether the measurements are considered critical or non-critical. Samples will be sent to MEL, a CLP laboratory, or a commercial laboratory.

The site will be visually assessed during the sampling event to confirm potential source locations and their associate PPEs. During this time, site-specific conditions (i.e., topography or visual evidence of contamination) will be evaluated and incorporated, when applicable, into the placement of sampling locations. Conditions potentially contributing to deviations from the projected sampling locations include new observations or information obtained in the field that warrant an altered sampling approach, difficulty in reaching a desired soil sampling depth caused by adverse soil conditions or obstructions, or limited access to a sampling location. Significant deviations from the planned sampling locations or number of samples to be collected will be discussed with the EPA TM before implementation and will be documented on a Sample Plan Alteration form. This form is included in Appendix B. Every attempt will be made to collect representative samples with the equipment being used. This section describes sample locations (Section 2.1.1); the global positioning system (Section 2.1.2); logistics (Section 2.1.3); coordination with Federal, State, and local authorities (Section 2.1.4); and the proposed schedule (Section 2.1.5).

##### 2.1.1 Sample Locations

Sample locations have been selected to achieve the objectives discussed in Section 1.3.1. Specific sampling locations will be determined at the time of sampling based on observations made in the field. A discussion of the sampling methodology is presented in Section 2.2.1.

All soil, sediment, and QC samples submitted to a CLP laboratory, MEL or commercial will be analyzed for TAL metals including mercury (Contract Laboratory Analytical Service [CLPAS] ILM05.3, MEL EPA 200 Series, or commercial SW Series) and PCBs (CLPAS OLM04.3, MEL SW Series, or commercial SW Series). A pH test will be performed on the surface water in the field. Table 2-2 presents the anticipated number and types of samples, analytical methods, specific requirements for sample container size and type, sample preservation and holding times, and special handling requirements for samples expected to be collected at the site. Table 2-3 summarizes the number of QA/QC proposed samples to be submitted according to the method requirements. Table 2-4 presents sample numbers and locations. Proposed sample locations are

illustrated on Figure 2-1 (Proposed Sample Location Map) and Figure 2-2 (Regional Sample Location Map). Specific sample locations listed on Table 2-4 that are not located on Figure 2-1 or 2-2 will be identified during the site visit prior to sampling. A summary of sampling locations and rationale is provided below.

#### 2.1.1.1 Source Area Samples

Ten potential source areas were identified based on information from ODEQ and background literature reviews: seven potential sources at the Upper Musick Mine and three potential sources at the Lower Musick Mine. Exact sample locations will be determined during the site investigation. The anticipated source sampling locations are as follows (Figure 2-1):

##### Upper Musick Mine

- *Waste Rock Pile*—At least one waste rock pile is expected to exist on the property due to the former mining operations. An XRF will be used to analyze the waste rock pile at a maximum of 15 locations to characterize the waste rock pile. One discrete surface soil sample will be collected and analyzed for TAL metals. The discrete sample will be selected from the waste rock pile with the highest XRF metals reading. All metals detected by the XRF will be recorded in the field log book. Sand-sized or finer material will be targeted during collection, if possible.
- *22-Ton Mill* —Records indicate a 22-ton stamp mill replaced the 5-ton stamp mill in 1935. An XRF will be used at a maximum of 15 locations to characterize the mill area. Three discrete surface soil samples will be collected from the mill area and analyzed for TAL metals. The discrete samples will be selected from the mill areas with the highest XRF metals reading. All metals detected by the XRF will be recorded in the field log book. Sand-sized or finer material will be targeted during collection, if possible. Additionally, soil samples will be collected at stained areas and analyzed for PCBs.
- *Tailing Piles*—At least two tailings piles have been identified by ODEQ. An XRF will be used to analyze both tailings piles at a maximum of 15 locations (within each pile) to characterize the tailings pile. One discrete surface soil sample will be collected and analyzed for TAL metals. The discrete sample will be selected from highest XRF metals reading within the tailings pile. All metals detected by the XRF will be recorded in the field log book. Sand-sized or finer material will be targeted during collection, if possible.
- *50-Ton Coarse Ore Bin*— Records indicate a 50-ton coarse ore bin was formerly located onsite. One discrete surface soil sample from the coarse ore bin will be collected and analyzed for TAL metals and mercury. Sand-sized or finer material will be targeted during collection, if possible.
- *Adit Drainage*—Two adits with potential AMD are expected to exist onsite. One surface sediment and one surface water sample will be collected from each adit entrance to document the possible release of contaminants into the surface water pathway. Each sediment and surface water sample will be analyzed for TAL metals and mercury. In addition to the laboratory analyses, the pH of the surface water will be tested in the field.



- *Samples of Opportunity*—Up to two additional discrete surface soil or sediment samples have been allotted due to the possibility of newly identified sources at the Upper or Lower Musick Mine (another adit, tailings pile, etc.). The field team will assess the site and determine if these additional samples are warranted and will collect the samples within the allowed field effort time frame. If possible, the field team will contact the site leader and discuss the additional samples.

#### Lower Musick Mine

- *Waste Rock Pile*—At least one waste rock pile is expected to exist on the property due to the former mining operations. An XRF will be used at a maximum of 15 locations to characterize the waste rock pile. One discrete surface soil sample will be collected and analyzed for TAL metals. The discrete sample will be selected from the waste rock pile with the highest XRF metals reading. All metals detected by the XRF will be recorded in the field log book. Sand-sized or finer material will be targeted during collection, if possible.
- *Tailings Pile*—A tailings pile is expected to exist on the property based on ODEQ observations. An XRF will be used at a maximum of 15 locations to characterize the tailings pile. One discrete surface soil sample will be collected and analyzed for TAL metals. The discrete sample will be selected from the tailings pile with the highest XRF metals reading. All metals detected by the XRF will be recorded in the field log book. Sand-sized or finer material will be targeted during collection, if possible.
- *Adit Drainage*—One adit with potential AMD is expected to exist onsite. One surface sediment and one surface water sample will be collected and analyzed for TAL metals and mercury from the adit entrance to document the possible release of contaminants into the surface water pathway. In addition to the laboratory analyses, the pH of the surface water will be tested in the field.

#### 2.1.1.2 Target Samples

#### Upper Musick Mine

The possible release of contamination to the environment will be documented by sampling within the following nearby surface water bodies (Figures 2-1 & 2-2):

- *City Creek PPE*—City Creek is located onsite and downgradient from the site. Depending on arterial PPE locations, a maximum of seven surface sediment samples will be collected from City Creek and analyzed for TAL metals including mercury at the location with the highest arsenic reading and PCBs at the 22-ton gravity concentration mill PPE: one from both tailings piles PPEs, one from the waste rock pile PPE, one from the 22-ton gravity concentration mill PPE, one from both adit drainages into City Creek PPEs (two adits), one from the 50-ton coarse ore bin PPE.
- *Champion Mine Attribution to City Creek*—One surface sediment and one surface water sample will be collected along the tributary that leads from Champion Mine to City Creek

and analyzed for TAL metals including mercury. In addition to the lab analyses, the pH of the surface water will be tested in the field.

- *Confluence of City Creek and Steamboat Creek*—One surface sediment and one surface water sample will be collected from the confluence of City Creek and Steamboat Creek and analyzed for TAL metals including mercury. In addition to the lab analyses, the pH of the surface water will be tested in the field.
- *Steamboat Attribution*—One sediment and one surface water sample will be collected upstream of the confluence on Steamboat Creek as an attribution sample and analyzed for TAL metals including mercury. In addition to the lab analyses, the pH of the surface water will be tested in the field.
- *Samples of Opportunity*—Up to two additional discrete sediment samples have been allotted for any newly identified sources discovered during the field effort (as discussed in Section 2.1.1.1) that have an associated PPE.

### Lower Musick Mine

The possible release of contamination to the environment will be documented by sampling within the following nearby surface water bodies (Figures 2-1):

- *Glenwood Creek Attribution*—One sediment and one surface water sample will be collected upstream of the Lower Musick Mine on Glenwood Creek as an attribution sample for the potential influence of Wildhog Mine on Glenwood Creek and analyzed for TAL metals and mercury. In addition to the lab analyses, the pH of the surface water will be tested in the field.
- *Glenwood Creek PPE*—Glenwood Creek is located on the site and downgradient from the site. Three surface sediment samples will be collected from Glenwood Creek: one from the tailings pile PPE, one from the waste rock pile PPE, and one from the adit drainage into Glenwood Creek PPE and analyzed for TAL metals and mercury.
- *Confluence of Glenwood Creek and Bohemia Creek*—One surface sediment and one surface water sample will be collected from the confluence of Glenwood Creek and Bohemia Creek and analyzed for TAL metals and mercury. In addition to the lab analyses, the pH of the surface water will be tested in the field.
- *Bohemia Creek Attribution*—One sediment and one surface water sample will be collected upstream of the confluence on Bohemia Creek as an attribution sample and analyzed for TAL metals and mercury. In addition to the lab analyses, the pH of the surface water will be tested in the field.

### *2.1.1.3 Background Samples*

Surface soil, sediment and surface water samples will be collected to represent background conditions of the sampled media at both the Upper and Lower Musick Mines as follows (Figure 2-2):

- *Surface Soil*—One representative background surface soil sample will be collected from an area not apparently impacted by human activity at the Musick Mine and the nearby mine



prospects as displayed on the USGS 7.5 minute topographic map of the area (Figure 2-2). The background soil sample will be collected from a location with similar conditions as the soil samples collected onsite and will be analyzed for TAL metals, mercury and PCBs.

- **Surface Sediment**—One representative background sediment sample will be collected from a stream location that is not apparently impacted by human activity at the Musick Mine and mine prospects displayed on the USGS 7.5 minute topographic map of the area (Figure 2-2). Since the Musick Mine is located near the head waters of the streams draining the mine area, collecting a background sediment sample from a location upgradient of the mine is not possible. The selected background sediment location is within an unnamed tributary to Martin Creek that drains an area apparently not impacted by mine activities. The location is also relatively accessible via a nearby gravel road. The background sediment sample will be collected from a location with similar conditions as the target sediment samples collected and will be analyzed for TAL metals, mercury and PCBs.
- **Surface Water**—One representative background surface water sample will be collected at the same location as the background sediment sample. The sample will be analyzed for TAL metals and mercury. In addition to the lab analyses, the pH of the surface water will be tested in the field.

### 2.1.2 Source Area Measurements

Information regarding the dimensions and boundaries of each source area will be measured using a handheld global positioning system (GPS) unit, measuring tape or wheel, laser range finder, or approximated by pacing. Source dimension and location information will be recorded in the project logbook or on an appropriate sampling form. All identified sources will be photographed

### 2.1.3 Global Positioning System

GPS readings from a Trimble GeoExplorer will be used to record the coordinates of sample locations, if possible, as well as to delineate the boundaries of the potential source areas. The data will be stored in location specific individual files, the names of which will be noted on the appropriate field sampling record (Appendix B). Differential GPS (DGPS) corrections of the GPS data to improve location accuracy will be performed by Mr. Matt Gubitosa of the EPA through post-processing following the field effort. DGPS coordinates will be provided in the final PA/SI report as an appendix.

### 2.1.4 Logistics

The Musick Mine is accessible by unpaved roads and/or trails. Weston personnel and equipment will fly to accommodations in Eugene, Oregon; a four-wheel-drive vehicle rented from a vendor in Eugene will be used for transportation to and from the site. All property owners and operators will have provided written or verbal consent to access their properties before PA/SI field activities begin.

The site will be assessed during the sampling event to confirm potential source locations and their associate PPEs. Samples collected for fixed laboratory analysis will be delivered to MEL, a



CLP laboratory, or a commercial laboratory as determined by the EPA. All samples will be shipped daily from Eugene, Oregon. Sample control and shipping are discussed in Section 2.3.

### **2.1.5 Coordination with Federal, State, and Local Authorities**

The START Site Leader will keep the TM apprised of field event progress and issues that may affect the schedule or outcome of the PA/SI, discuss problems encountered, inform EPA of unusual contacts with the public or the media, and obtain technical direction from EPA regarding project activities when required. Additionally, Weston field personnel will notify the EPA RSCC with changes to the sampling schedule for CLP analyses and provide shipping information on every sample shipment within 24 hours of shipment or before noon on Friday for Saturday delivery.

## **2.2 SAMPLING METHODS REQUIREMENTS**

This section describes sampling methodologies (Section 2.2.1); sampling equipment decontamination (Section 2.2.2); and investigation-derived wastes (Section 2.2.3).

### **2.2.1 Discrete Sampling Methodologies**

The START Site Leader and EPA TM will be responsible for ensuring that appropriate sample collection procedures are followed and will take appropriate actions to correct the deficiencies. The surface water and sediment sampling effort will begin at the station farthest downstream, and sampling will progress in a downgradient-to-upgradient sequence. All sample containers that will be used in sampling will be "QC Grade" with the corresponding certificates of analysis maintained in the project file. All samples collected will be maintained under chain-of-custody and will be stored and shipped in iced coolers.

#### *2.2.1.1 Surface Soil Sampling*

The discrete surface soil samples (0 to 0.5 foot bgs) will be collected in accordance with Weston SOP RFW/R10-001 (Appendix A), with the exception that no field duplicates will be collected per EPA direction. The discrete sample will be collected using decontaminated hand tools such as a stainless steel spoon for PCB collection or dedicated plastic spoon for other analyses. The sand-sized and finer fractions of the material will be targeted for collection. A physical description of the sample will be recorded on a field sampling form (Appendix B). A representative sample will be placed into a pre-labeled sample container. Any excess sample material collected will be returned to the sampling location. Samples will be stored in an iced cooler prior to shipment to the analytical laboratory.

#### *2.2.1.2 Surface Sediment Sampling*

Surface sediment samples (0 to 0.5 foot bgs) will be collected in accordance with Weston SOP RFW/R10-003 (Appendix A), with the exception that no field duplicates will be collected per EPA direction. The samples will be collected using decontaminated hand tools such as a stainless steel spoon for PCB collection or dedicated plastic spoon for other analyses. Sample



material will be examined and a physical description will be recorded on a surface sediment field sampling record (Appendix B). The physical description will include estimated grain size proportions (percent clay, silt, sand, and gravel), organic content, color, odor, etc. Any excess sample material collected will be returned to the sampling location. Samples will be stored in an iced cooler prior to shipment to the analytical laboratory.

#### 2.2.1.3 Surface Water Sampling

Surface water samples (0 foot bgs) will be collected in accordance with Weston SOP RFW/R10-004 (Appendix A), with the exception that no field duplicates will be collected. The samples will be collected using by placing the appropriate sample container under the water surface pointing the container upstream. Sample material will be examined and a physical description will be recorded on a surface water field sampling record (Appendix B). Samples will be stored in an iced cooler prior to shipment to the analytical laboratory.

### 2.2.2 XRF Screening Methodology

As discussed in Section 2.1.1 an XRF spectrometer will be utilized to screen potential sources onsite. The sand-sized and finer fractions of soil will be targeted for screening. Mercury and arsenic results from the XRF will be used as a relative indicator of contamination in these areas, and each location and result will be recorded in the logbook. The latitude/longitude coordinates at the two initial screening locations will be located using a handheld GPS unit. The locations of the remaining screening sites will be recorded in reference to these GPS coordinate locations by pacing. After the locations are screened with the XRF, the screening location showing the highest designated metal concentrations in each grid will be collected.

### 2.2.3 Sampling Equipment

Disposable and/or dedicated personal protective and sampling equipment will be used to avoid cross-contamination.

### 2.2.4 Investigation-Derived Wastes

Weston field team members will make every effort to minimize the generation of investigation-derived wastes (IDW) throughout the field event. Disposable personal protective clothing and sampling equipment generated during field activities will be rendered unusable by tearing (when appropriate), bagged in opaque plastic garbage bags, and disposed of at an approved solid waste disposal facility.

## 2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

This section describes sample identification and chain-of-custody procedures that will be used for the Musick Mine PA/SI field activities. The purpose of these procedures is to ensure that the quality of samples is maintained during collection, transportation, storage, and analysis. All chain-of-custody requirements comply with Weston's SOPs for sample handling. All sample control and chain-of-custody procedures will follow the *Contract Laboratory Program Guidance for Field Samplers* (EPA 2001).

Examples of sample documents used for custody purposes are provided in Appendix C and include the following:

- Sample identification numbers
- Sample tags or labels
- Custody seals
- Chain-of-custody and/or traffic report records
- Field logbooks
- Sample collection forms

During the field effort, the Site Leader or delegate is responsible for maintaining an inventory of these sample documents. This inventory will be recorded in a cross-referenced matrix of the following:

- Sample location
- Sample identification number
- Analyses requested and request form number(s)
- Bottle lot numbers
- Air bill numbers

Brief descriptions of the major sample identification and documentation records and forms are provided below.

### 2.3.1 Sample Identification (ID)

All samples will be identified using the sample numbers assigned by the EPA RSCC. Each sample label will be affixed to the sample container and covered with Mylar tape or a water proof label will be used. A sample tracking record will be kept as each sample is collected. The following will be recorded: sample location, matrix, sample number, observations, and depth.

In addition to the EPA sample numbers, all samples collected will be assigned a unique Weston identification code based on a consistent sample designation scheme that will be used internally by Weston and in the final report. The sample designation scheme is designed to suit the needs of the field staff, data management and data users and will not be provided to the analytical laboratory.

All samples will consist of four components separated by a dash. These components are site ID, media code, station code, and sample type. Table 2-4 presents sample numbers and locations. Table 2-5 summarizes the sample tracking code and location. The sample designation scheme is as follows:

Site ID		Media Code		Station Code		Sample Type
UMM	-	SD	-	MSsss	-	t [ddd]
or						
LMM						

The four components are described in the following sections.



### Site ID

The site ID component is a three-digit code that designates the specific SI sample. This is based on the Weston project phase code. The Site ID code assigned to this investigation is UMM for Upper Musick Mine or LMM for Lower Musick Mine.

### Media Code

The media code is a two-character code that defines the media type of the field sample. The media codes designated for this project are as follows:

SD — Sediment  
SS — Surface Soil  
SW — Surface Water

### Station Code

The station code component is a five-character code that uniquely identifies each sampling station. The station code component has two parts: a two-letter station designation indicating the area where the sample was collected followed by a three number sequential component (i.e., 001, 002, 003). The station codes designated for this project are as follows:

MS — Mine Source  
ST — Stream  
BK — Background

### Sample Type

The sample type component has two parts: a sample type field “t” and a sample depth field “ddd.” The single character “t” indicates a sample type having one of the following values:

0### — Field sample

and a three-character field to indicate depth in tenths of feet to the top of the sample:

#000 — 0 foot (surface)  
#005 — 0.5 foot  
#010 — 1.0 foot

Sample depth determinations will be made to the nearest 0.5 foot.

### Examples

Examples of complete sample numbers with descriptions are as follows:

UMM-SS-MS001-0000: A field surface soil sample collected from mine source station MS001 from the surface to a depth of 0.5 feet bgs at the Upper Musick Mine.

- UMM-SD-ST001-0005: A field surface sediment sample collected from stream station ST001 from the surface to a depth of 0.5 feet bgs at the Upper Musick Mine.
- UMM-SW-ST001-0000: A field surface water sample collected from stream station ST001 from the surface at the Upper Musick Mine.

Under the sample designation method described above, the identifier will be unique (i.e., no two samples will have the same identifier), and informative (i.e., will show method of collection, location, sample type, and depth interval). This designation scheme will facilitate data management and tracking during the evaluation and reduction of PA/SI data.

Since the proposed sample designation scheme contains a great deal of specific sample information, the sample number will not be entered on laboratory chain-of-custody forms. The EPA sample number and regional tracking number will be used to identify samples. Weston will maintain a cross-reference of the proposed sample designation scheme numbers and EPA sample numbers.

#### *2.3.1.1 Sample Tags and Labels*

Sample tags attached to or fixed around the sample container will be used to identify all samples collected in the field. The sample tags will be placed on bottles so as not to obscure any QA/QC lot numbers on the bottles, and sample information will be printed legibly. Field identification will be sufficient to enable cross-reference with the project logbook and/or field sampling record forms. For chain-of-custody purposes, all QA/QC samples will be subject to the same custodial procedures and documentation as site samples.

To minimize handling of sample containers, labels will be completed before sample collection to the extent possible. In the field the label will be filled out completely using waterproof ink, then attached firmly to the sample containers and protected with Mylar tape or waterproof labels will be used. The sample label will provide the following information:

- Sample number
- Sample location number
- Date and time of collection
- Analysis required
- Preservative (when applicable)
- Sampler's initials

#### *2.3.1.2 Custody Seals*

Custody seals are preprinted gel-type seals, designed to break if the seals are disturbed. Sample shipping containers (e.g., coolers, drums, and cardboard boxes, etc., as appropriate) will be sealed in as many places as necessary to ensure security. Seals will be signed and dated before use. Upon receipt at the laboratory, the custodian will check (and certify by completing the package receipt log) that seals on shipping containers are intact.



### 2.3.1.3 Chain-of-Custody Records and Traffic Reports

The chain-of-custody record and analytical traffic reports will be completed fully at least in duplicate by the field technician designated by the Site Leader as responsible for sample shipment to the appropriate laboratory. Information specified on the chain-of-custody record will contain the same level of detail found in the site logbook, except that the on-site measurement data will not be recorded. The custody record will include the following information:

- Name and company or organization of person collecting the samples
- Date samples were collected
- Type of sampling conducted
- Sample number (using those assigned by the EPA RSCC)
- Number of containers shipped
- Analysis requested
- Signature of the person relinquishing samples to the transporter, with the date and time of transfer noted and signature of the designated sample custodian at the receiving facility

If samples require rapid laboratory turnaround, the person completing the chain-of-custody record will note these or similar constraints in the remarks section of the custody record. If samples are suspected to contain high levels of contaminants or biohazards, specific notations will be made on the chain-of-custody.

The relinquishing individual will record all shipping data (e.g., air bill number, organization, time, and date) on the original custody record, which will be transported with the samples to the laboratory and retained in the laboratory's file. Original and duplicate custody records, together with the air bill or delivery note, constitute a complete custody record. It is the Site Leader's responsibility to ensure that all records are consistent and that they become part of the permanent project file.

### 2.3.1.4 Field Logbooks and Data Forms

Field logbooks (or daily logs) and data forms are necessary to document daily activities and observations. Documentation will be sufficient to enable participants to reconstruct events that occurred during the project accurately and objectively at a later time. All entries will be made in waterproof ink, dated, and signed. No pages will be removed from the logbook for any reason. If corrections are necessary, these corrections will be made by drawing a single line through the original entry (so that the original entry is legible) and writing the corrected entry alongside. The correction will be initialed and dated. Corrected errors may require a footnote explaining the correction.

### 2.3.1.5 Photographs

Photographs will be taken as directed by the field team leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the logbook or relevant sampling form concerning photographs:

- Date and location where photograph was taken
- Photographer
- Description of photograph taken
- Sequential number of the photograph and the film roll number

### 2.3.2 Custody Procedures

The primary objective of chain-of-custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection to completion of all required analyses. A sample is in custody when it is:

- In someone's physical possession
- In someone's view
- Locked up, or kept in a secured area that is restricted to authorized personnel

#### 2.3.2.1 Field Custody Procedures

The following guidance will be used to ensure proper control of samples while in the field:

- As few people as possible will handle samples.
- Coolers or boxes containing cleaned bottles will be sealed with a custody tape seal during transport to the field or while in storage before use. Sample bottles from unsealed coolers or boxes, or bottles that appear to have been tampered with, will not be used.
- The sample collector will be responsible for the care and custody of collected samples until they are transferred to another person or dispatched properly under chain-of-custody rules.
- The sample collector will record sample data in the field logbook.
- The site team leader will determine whether proper custody procedures were followed during the fieldwork and will decide if additional samples are required.
- All coolers will be accompanied by a temperature blank.
- Packaging, marking, labeling, and shipping of samples will comply with all regulations promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171-177 and International Air Transport Association (IATA) regulations.

When transferring custody (i.e., releasing samples to a shipping agent), the following will apply:

- The coolers in which the samples are packed will be sealed and accompanied by one copy of the chain-of-custody record. When transferring samples, the individuals relinquishing



and receiving them must sign, date, and note the time on the chain-of-custody record. This record will document sample custody transfer.

- Samples will be dispatched to the laboratory for analysis with separate chain-of-custody records accompanying each shipment. Shipping containers will be sealed with custody seals for shipment to the laboratory. The chain-of-custody records will be signed by the relinquishing individual, and the method of shipment, name of courier, and other pertinent information will be entered in the chain-of-custody record before placement in the shipping container.
- All shipments will be accompanied by chain-of-custody records identifying their contents. The original custody records kept in a resealable plastic bag and taped inside the lid of the cooler will accompany the shipment. The other copies will be distributed appropriately to the Site Leader and Project Manager.
- If sent by common carrier, a bill of lading will be used. Freight bills and bills of lading will be retained as part of the permanent documentation.

#### 2.3.2.2 Laboratory Custody Procedures

A designated sample custodian at the laboratory will accept custody of the shipped samples from the carrier and enter preliminary information about the package into a package or sample receipt log, including the initials of the person delivering the package and the status of the custody seals on the coolers (i.e., broken versus unbroken). The custodian responsible for sample log-in will follow the laboratory's SOP for opening the package, checking the contents, and verifying that the information on the chain-of-custody agrees with samples received. The laboratory will check the temperature blank inside the cooler and document it in the sample log-in form. Should the temperature be greater than what is required by the method, the lab will notify the RSCC or Weston contact and proceed to follow the course of actions specified by Weston's QA Officer.

## 2.4 ANALYTICAL METHODS REQUIREMENTS

Analysis of samples collected during the PA/SI will be performed by MEL, a CLP laboratory, or a commercial laboratory as determined by the EPA. The analyses to be applied to samples sent to each laboratory are listed in Table 2-3. These analyses were selected based on the probable hazardous substances used or potentially released to the environment, given the known or suspected site usage.

Laboratory analyses will take place under the standard three-week turnaround time period. Table 2-3 summarizes laboratory instrumentation and methods to be used for the PA/SI.

## 2.5 QUALITY CONTROL REQUIREMENTS

QC checks for sample collection will be accomplished by a combination of chain-of-custody protocols and laboratory quality assurance as prescribed in the sampling or analytical methods. No QC samples (i.e., double blind performance evaluation samples) are planned for this activity outside of normal laboratory QC criteria outlined in the analytical methods. These QC measures



include analysis of rinsate, method blanks, matrix, spikes recovery, serial dilution, and calibration check samples; results from these samples will be compared to QC requirements listed in Section 4.1. All of the analyses that will be performed for this project will produce definitive data. Bias on estimated flagged data shall be determined by the validation process. The laboratories' DQOs for completeness and the field team's ability to meet the DQO for representativeness are set at 90% for sediment/soil and 95% for water. Precision and accuracy requirements are outlined in Table 2-3.

## **2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS**

The field equipment used during this project includes an XRF spectrometer and a GPS unit (as part of the site Health and Safety Plan). Testing, inspection, and maintenance of these instruments will be performed in accordance with the manufacturer's recommendations and/or the SOPs provided in Appendix A. Spare parts for the field equipment will be available from the manufacturer generally within 24 hours.

All field instruments and equipment used for analysis will be serviced and maintained only by qualified personnel. Senior staff and/or electronics technicians will maintain all instruments. All repairs, adjustments, and calibrations will be documented in an appropriate logbook or data sheet that will be kept on file. The instrument maintenance logbooks will clearly document the date, the description of the problems, the corrective action taken, the result, and who performed the work.

All equipment used by Weston in the field is subject to standard preventive maintenance schedules established by corporate equipment protocols. When in use, equipment will be inspected at least twice daily, once before startup in the morning and again at the end of the work shift before overnight storage or return to the charging rack. Regular maintenance, such as cleaning and charging, is to be conducted according to manufacturer's recommendations and in the field as needed, whichever is appropriate. All performed preventive maintenance will be entered in the individual equipment's logbook and/or in the site field logbook.

In addition to preventive maintenance procedures, daily calibration checks will be performed at least once daily before use and recorded in the respective logbooks. Additional calibration checks will be performed as required by manufacturer's recommendations. All logbooks will become part of either the permanent project file or the permanent equipment file.

## **2.7 INSTRUMENT CALIBRATION AND FREQUENCY**

All instruments and equipment used during fixed laboratory sample analyses will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations, as well as criteria set forth in the applicable analytical methodology references and/or in accordance with the laboratory's QA Manual and SOPs.



For field instrumentation (i.e.; GPS unit), the calibration will be performed in accordance with the manufacturer's recommendations.

## **2.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES**

This information is covered by the SOPs and the START QMP (Weston 2003). Standards contained in these documents will be used to ensure the validity of data generated by Weston for this project. Sample jars are pre-cleaned by the manufacturer; certification documenting this is enclosed with each box of jars. The START will include this documentation as part of the project file.

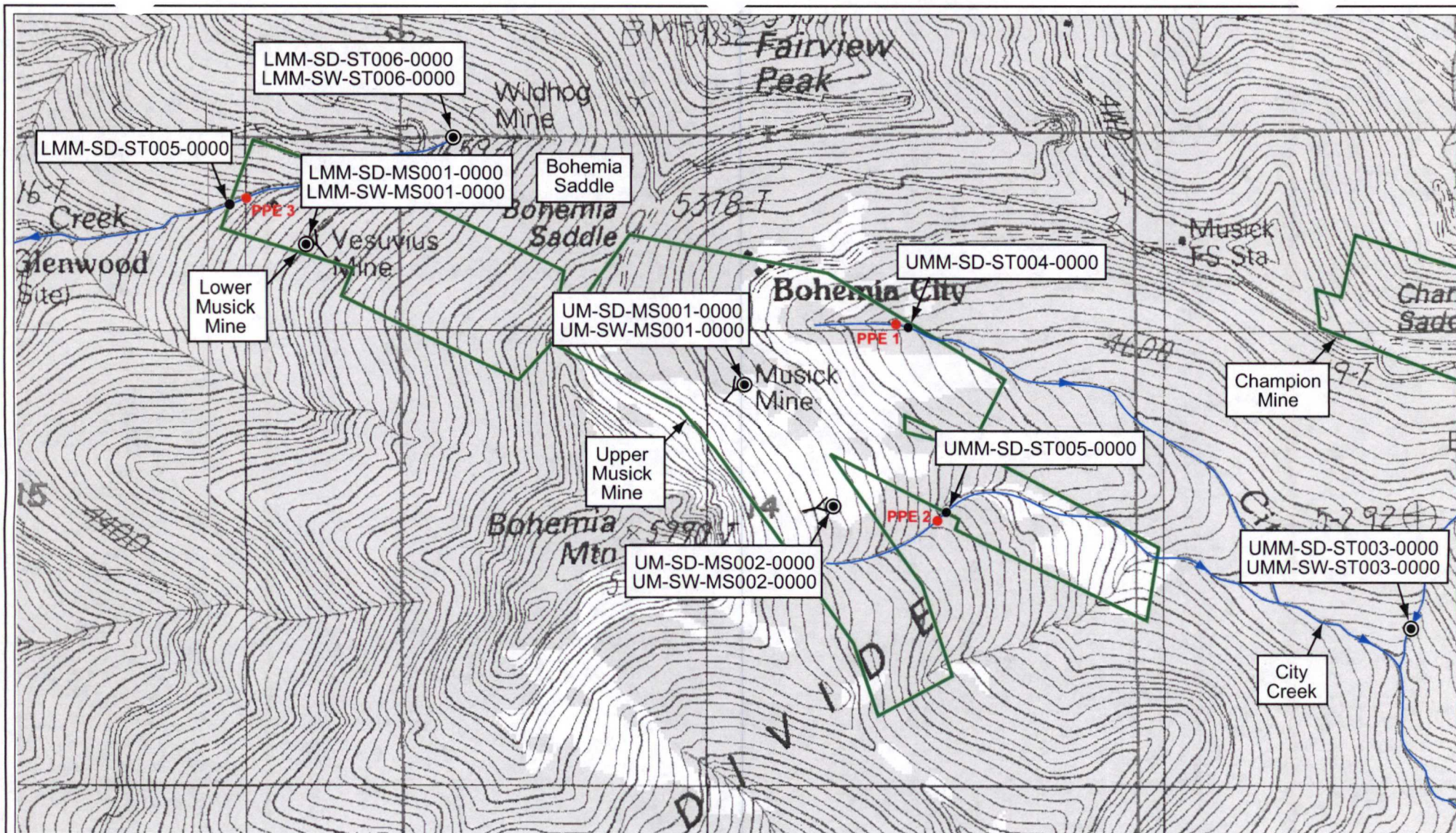
## **2.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)**

No data will be used from other sources.

## **2.10 DATA MANAGEMENT**

Hardcopy results from the MEL and/or CLP laboratories will be delivered to the EPA upon completion of each sample delivery group. Electronic results from the MEL and/or CLP laboratories will be delivered to the EPA upon project completion. Hardcopy and electronic data results from the START-subcontracted commercial laboratory will be delivered to Weston upon completion of each sample delivery group. A full documentation data deliverable (raw and final data) will be submitted by the subcontract laboratory; data validation will be performed as listed in Section 4.1.





Source: USGS 7.5' Series Topo, Fairview Peak-OR, 1986.



- Property Boundary
- Probable Point of Entry (PPE)
- Surface Water Flow Direction
- Y Adit
- Proposed Soil/Sediment Sample Location
- Proposed Surface Water Sample Location

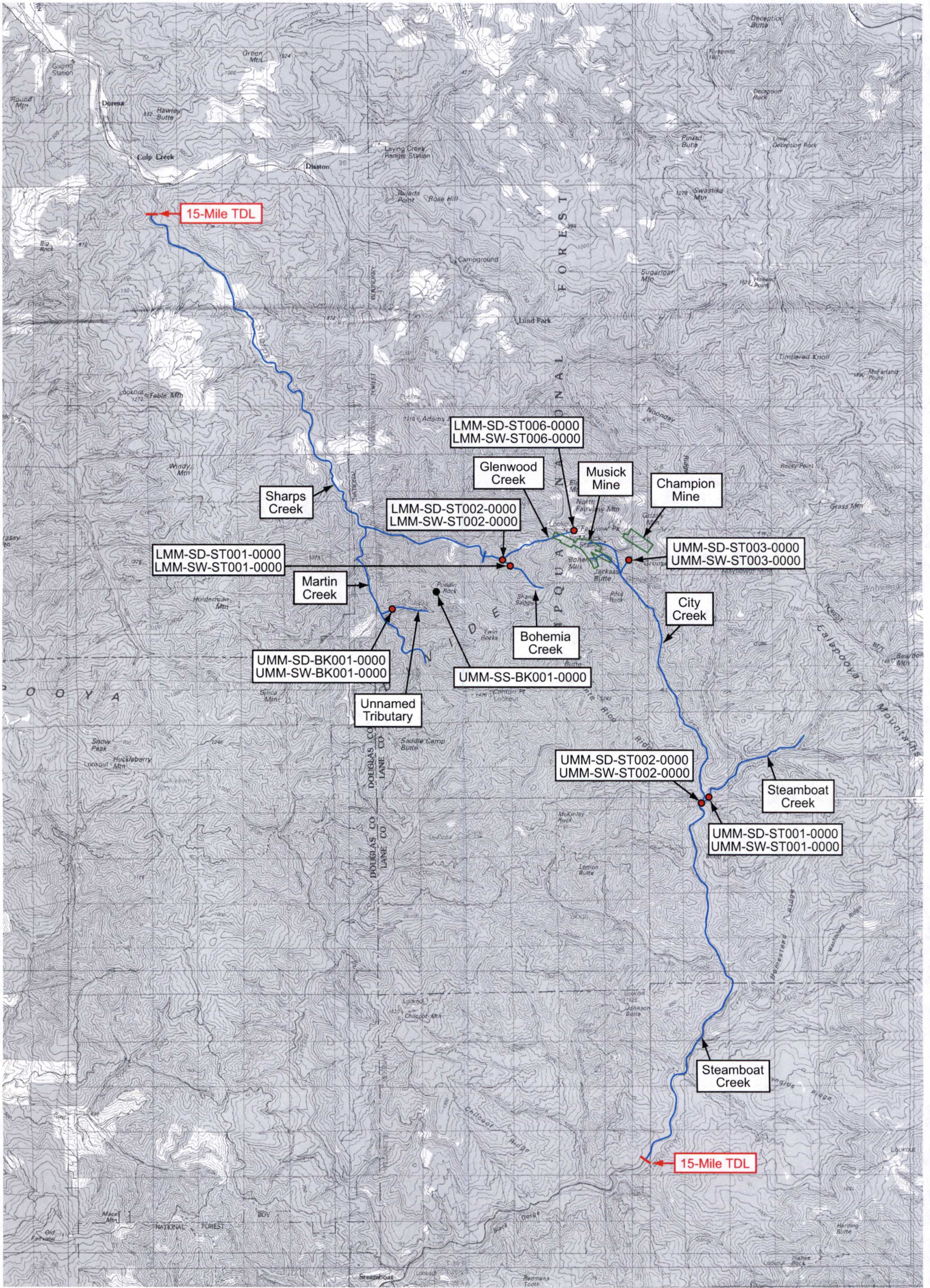
Note: Additional Sample Locations will be identified during the site visit.

## Proposed Sample Location Map Musick Mine PA/SI Lane County, Oregon

Figure

**2-1**





Source: USGS 1:100,000 Scale Series Topo, Diamond Lake-OR, 1978 and Oakridge-OR, 1983.



- Property Boundary
- Surface Water
- Proposed Soil Sample Location
- Proposed Sediment/Surface Water Sample Location

# Regional Proposed Sample Location Map Musick Mine PA/SI Lane County, Oregon

Figure  
2-2







**Table 2-1—Sample Information Summary  
Musick Mine PA/SI  
Lane County, Oregon**

Project Sampling Schedule <sup>a</sup>	Parameter/Limits	Design Rationale	Sampling Design Assumptions	Sample Selection Procedures	Measurement Classification (Critical/Noncritical)	Nonstandard Method Validation
Surface Soil	TAL Metals and Mercury/CRQL  PCBs/CRQL	Identify potential contamination source(s)	Contaminants were released to soil	Samples will be collected from potential source areas*	Critical	NA
Sediment	TAL Metals and Mercury/CRQL  PCBs/CRQL	Determine if contaminants have migrated to surface sediments	Contaminants were released to sediments	Samples will be collected from potentially contaminated areas*	Critical	NA
Surface Water	TAL Metals and Mercury/CRQL	Determine if contaminants have migrated to surface water	Contaminants were released to surface water	Samples will be collected from potentially contaminated areas*	Critical	NA

Notes:

<sup>a</sup> All samples will be collected during the field event.

\* As indicated from background information for the site.

Critical: Required to achieve project objectives or limits on decision errors.

CRQL: Contract Required Quantitation Limit for ILM05.

NA: Not Applicable.

PCB: Polychlorinated Biphenyls

TAL: Target Analyte List

**Table 2-2—Sample Analyses Summary  
Musick Mine PA/SI  
Lane County, Oregon**

Matrix	Location and Number of Samples <sup>a</sup>	Analytical Parameters and Method	Sample Preservation	Technical Holding Time <sup>b</sup>	Sample Container(s)
Soil	<i>Upper Musick</i> Tailings Piles (2 samples) Waste Rock Pile (1 sample) 22-Ton Stamp Mill (3 samples) 50-Ton Ore Bin (1 sample)	TAL Metals and Mercury CLPAS ILM05.3 or EPA SW846 6010B and 7471 or EPA 200 Series	Cool to 4°C ±2°C	TAL Metals: 6 months (mercury 28 days)	One 4-oz. wide-mouth glass jar with Teflon lid.  No extra containers necessary, indicate MS/Dup on one of the above soil or sediment samples.
	<i>Lower Musick</i> Tailings Pile (1 sample) Waste Rock Pile (1 sample)				
	Samples of Opportunity (Up to 2 samples) Background (1 sample) QC Soil MS/Dup				
	<i>Upper Musick</i> 22-Ton Stamp Mill (3 samples) QC Soil MS/Dup				
Sediment	<i>Upper Musick</i> Adit Entrances (2 samples) PPEs (7 samples: 2 tailings pile PPEs, 1 waste rock PPE, 1 22-ton mill PPE, 1 50-ton ore bin PPE, 2 adit PPEs) Champion Mine attribution to City Creek (1 sample) City Creek/Steamboat Creek Confluence (1 sample) Steamboat Creek attribution (1 sample)	PCBs CLPAS OLM04.3 or EPA SW846 8082	Cool to 4°C ±2°C	Extract within 14 days of collection; analyze within 40 days of extraction	One 4-oz. wide-mouth glass jar with Teflon lid.
	<i>Lower Musick</i> Adit Entrance (1 sample) PPEs (3 samples: 1 tailings pile PPE, 1 waste rock pile PPE, 1 adit PPE) Glenwood Creek Attribution (1 sample) Glenwood Creek/Bohemia Creek Confluence (1 sample) Bohemia Creek attribution (1 sample)				
	Samples of Opportunity (Up to 2 PPE samples) Background (1 sample) QC Sediment MS/Dup				



**Table 2-2—Sample Analyses Summary  
Musick Mine PA/SI  
Lane County, Oregon**

Matrix	Location and Number of Samples <sup>a</sup>	Analytical Parameters and Method	Sample Preservation	Technical Holding Time <sup>b</sup>	Sample Container(s)
Sediment	<i>Upper Musick</i> 22-ton mill PPE (1 sample) QC Sediment MS/Dup	PCBs (CLPAS) OLM04.3 Or EPA SW846 8082	Cool to 4°C ±2°C	Extract within 14 days of collection; analyze within 40 days of extraction	One 8-oz. wide-mouth glass jar with Teflon-lined lid.
Surface Water	<div> <i>Upper Musick</i>  Adit Entrances (2 samples)  Champion Mine attribution to City Creek (1 sample)  City Creek/Steamboat Creek Confluence (1 sample)  Steamboat Creek attribution (1 sample) </div> <div> <i>Lower Musick</i>  Adit Entrance (1 samples)  Glenwood Creek Attribution (1 sample)  Glenwood Creek/Bohemia Creek Confluence (1 sample)  Bohemia Creek attribution (1 sample)  QC Water MS/Dup (1 sample)  Background (1 sample) </div>	TAL Metals and Mercury CLPAS ILM05.3 or EPA SW846 6010B and 7470 or EPA 200 Series  Litmus test for pH in the field	Nitric Acid to pH<2; Cool to 4°C ±2°C	TAL Metals: 6 months (mercury 28 days)	One 500-ml HDPE

Notes:

<sup>a</sup>Total number of field samples is an estimate; the actual number of samples collected will be determined in the field.

°C: Degrees Celsius.

CLPAS: Contract Laboratory Program Analytical Services

HDPE: High Density Polyethylene

ILM: Inorganic Laboratory Methods

MS/Dup: Matrix Spike/Duplicate

L: Liter.

Oz: Ounce.

OLM: Organic Laboratory Methods

PCBs: Polychlorinated Biphenyls

PPE: Probable Point of Entry

QC: Quality Control.

SW: EPA Solid Waste and Emergency Response

TAL: Target analyte list.

**Table 2-3—QA/QC Analytical Summary and Fixed Laboratory Analytical Methods  
Musick Mine PA/SI  
Lane County, Oregon**

Laboratory	Matrix	Parameters/ Method	Method Description/ Detection Limits	Total Field Samples <sup>a</sup> / Containers	QA/QC Sample Summary Analyses/Containers				Total Field and QA/QC Analyses/ Containers <sup>d</sup>	Precision and Accuracy
					Field Duplicates	Inorganic MS/Dup <sup>b</sup>	Organic MS/Dup <sup>b</sup>	Rinsate Blanks <sup>c</sup>		
CLP/MEL	Soil	TAL Metals + Hg CLPAS ILM05.3 or EPA SW846 6010B/7471 or EPA 200 Series	ICP/AES & CVAA	12/12	NA	1/0	NA	0/0	13/12	75%-125% ±20%
		PCBs CLPAS OLM04.3 or EPA SW846 8082	GCS-ECD/CRQL	3/3	NA	NA	1/0	0/0	3/3	per SOW/SOP
CLP/MEL	Sediment	TAL Metals + Hg CLPAS ILM05.3 or EPA SW846 6010B/7471 or EPA 200 Series	ICP/AES & CVAA	22/22	NA	2/0	NA	0/0	24/22	75%-125% ±20%
		PCBs CLPAS OLM04.3 or EPA SW846 8082	GCS-ECD/CRQL	1/1	NA	NA	1/0	0/0	2/1	per SOW/SOP



**Table 2-3—QA/QC Analytical Summary and Fixed Laboratory Analytical Methods  
Musick Mine PA/SI  
Lane County, Oregon**

Laboratory	Matrix	Parameters/ Method	Method Description/ Detection Limits	Total Field Samples <sup>a</sup> / Containers	QA/QC Sample Summary Analyses/Containers				Total Field and QA/QC Analyses/ Containers <sup>d</sup>	Precision and Accuracy
					Field Duplicates	Inorganic MS/Dup <sup>b</sup>	Organic MS/Dup <sup>b</sup>	Rinsate Blanks <sup>c</sup>		
CLP/MEL	Surface Water	TAL Metals + Hg CLPAS ILM05.3 or EPA SW846 6010B/7470 or EPA 200 Series	ICP/AES & CVAA	10/10	NA	1/2	NA	0/0	11/12	75%-125% ±20%

Notes:

<sup>a</sup> Total number of field samples is estimated.

<sup>b</sup> No extra volume is required for soil/sediment. Sample numbers are based on one matrix spike/duplicate (MS/Dup) per 20 samples per matrix.

<sup>c</sup> The total number of rinsate samples could vary depending on the total number of samples collected. The sample numbers are based on one rinsate per 10 samples per non-dedicated sampling device and one rinsate per dedicated sampling device. Note that rinsate blanks consist of water aliquots for both soil and water field samples.

<sup>d</sup> Total analyses and containers includes both field and QA/QC aliquots to be submitted for fixed laboratory analysis.

CLP: Contract Laboratory Program.

CLPAS: Contract-Laboratory Program Analytical Service.

CRQL: Contract-Required Quantitation Limit for ILM05.3.

CVAA: Cold Vapor Atomic Absorption

Dup: Duplicate

ECD: Electron Capture Detection

GCS: Gas Chromatographic Separation

ICP: Inductively Coupled Plasma

ILM: Inorganic Laboratory Methods

MEL: Manchester Environmental Laboratory

MSD: Matrix Spike Duplicate.

NA: Not Applicable.

OLM: Organic Laboratory Methods

PCB: Polychlorinated biphenyls

QA: Quality Assurance.

QC: Quality Control.

TAL: Target analyte list

AES: Atomic Emission Spectrometry

**Table 2-4—Sample Numbers and Locations  
Musick Mine PA/SI  
Lane County, Oregon**

Weston Sample ID	Location/Description	Media	TAL Metals	PCBs
LMM-SD-ST001-0000	Bohemia Creek Attribution	Sediment	1-8 oz	NA
LMM-SW-ST001-0000	Bohemia Creek Attribution	Surface Water	1-500 ml	NA
LMM-SD-ST002-0000	Glenwood/Bohemia Creek Confluence	Sediment	1-8 oz	NA
LMM-SW-ST002-0000	Glenwood/Bohemia Creek Confluence	Surface Water	1-500 ml	NA
LMM-SD-ST003-0000	Waste Rock PPE	Sediment	1-8 oz	NA
LMM-SD-ST004-0000	Tailings PPE	Sediment	1-8 oz	NA
LMM-SD-ST005-0000	Adit Drainage PPE	Sediment	1-8 oz	NA
LMM-SD-ST006-0000	Glenwood Creek Attribution	Sediment	1-8 oz	NA
LMM-SW-ST006-0000	Glenwood Creek Attribution	Surface Water	1-500 ml	NA
LMM-SD-MS001-0000	Adit Entrance	Sediment	1-8 oz	NA
LMM-SW-MS001-0000	Adit Entrance	Surface Water	1-500 ml	NA
LMM-SS-MS002-0000	Waste Rock Pile	Soil	1-8 oz	NA
LMM-SS-MS003-0000	Tailings Pile	Soil	1-8 oz	NA
UMM-SD-ST001-0000	Steamboat Creek Attribution	Sediment	1-8 oz	NA
UMM-SW-ST001-0000	Steamboat Creek Attribution	Surface Water	1-500 ml	NA
UMM-SD-ST002-0000	City/Steamboat Creek Confluence	Sediment	1-8 oz	NA
UMM-SW-ST002-0000	City/Steamboat Creek Confluence	Surface Water	1-500 ml	NA
UMM-SD-ST003-0000	Champion Mine Attribution	Sediment	1-8 oz	NA
UMM-SW-ST003-0000	Champion Mine Attribution	Surface Water	1-500 ml	NA
UMM-SD-ST004-0000	Adit Drainage PPE	Sediment	1-8 oz	NA
UMM-SD-ST005-0000	Adit Drainage PPE	Sediment	1-8 oz	NA
UMM-SD-ST006-0000	Tailings Pile PPE	Sediment	1-8 oz	NA
UMM-SD-ST007-0000	Tailings Pile PPE	Sediment	1-8 oz	NA
UMM-SD-ST008-0000	Waste Rock Pile PPE	Sediment	1-8 oz	NA
UMM-SD-ST009-0000	50-Ton Ore Bin PPE	Sediment	1-8 oz	NA
UMM-SD-ST010-0000	22-Ton Mill PPE	Sediment	1-8 oz	1-8 oz
UMM-SD-ST011-0000	Newly Identified PPE	Sediment	1-8 oz	NA
UMM-SD-ST012-0000	Newly Identified PPE	Sediment	1-8 oz	NA
UMM-SD-MS001-0000	Adit Entrance	Sediment	1-8 oz	NA
UMM-SW-MS001-0000	Adit Entrance	Surface Water	1-500 ml	NA
UMM-SD-MS002-0000	Adit Entrance	Sediment	1-8 oz	NA
UMM-SW-MS002-0000	Adit Entrance	Surface Water	1-500 ml	NA
UMM-SS-MS003-0000	Tailings Pile	Soil	1-8 oz	NA



**Table 2-4—Sample Numbers and Locations  
Musick Mine PA/SI  
Lane County, Oregon**

Weston Sample ID	Location/Description	Media	TAL Metals	PCBs
UMM-SS-MS004-0000	Tailings Pile	Soil	1-8 oz	NA
UMM-SS-MS005-0000	Waste Rock Pile	Soil	1-8 oz	NA
UMM-SS-MS006-0000	50-Ton Ore Bin	Soil	1-8 oz	NA
UMM-SS-MS007-0000	22-Ton Mill	Soil	1-8 oz	1-8 oz
UMM-SS-MS008-0000	22-Ton Mill	Soil	1-8 oz	1-8 oz
UMM-SS-MS009-0000	22-Ton Mill	Soil	1-8 oz	1-8 oz
UMM-SS-MS0010-0000	Newly Identified Source	Soil	1-8 oz	NA
UMM-SS-MS0011-0000	Newly Identified Source	Soil	1-8 oz	NA
<i>Background Sample</i>				
UMM-SD-BK001-0000	Background Sediment	Sediment	1-8 oz	NA
UMM-SW-BK001-0000	Background Surface Water	Surface Water	1-500 ml	NA
UMM-SS-BK001-0000	Background Soil	Soil	1-8 oz	NA

Note: Sample IDs and locations subject to change based on field conditions.

**Table 2-5—Sample Coding  
Musick Mine PA/SI  
Lane County, Oregon**

Digits	Descriptions	Code Example
1,2,3	Site ID	UMM (Upper Musick Mine)
		LMM (Lower Musick Mine)
4,5	Media Code	SD (Surface Sediment)
		SS (Surface Soil)
		SW (Surface Water)
6,7	Station Code	MS (Mine Source)
		ST (Stream)
		BK (Background)
8,9,10	Consecutive Sample Number	001 (First Sample of Station Code)
11	Sample Type	0 (Field Sample)
12,13,14	Sample Depth (feet bgs)	000 (0 ft bgs = surface sample)
		005 (0.5 ft bgs)



## **SECTION 3**

### **ASSESSMENT/OVERSIGHT**

#### **3.1 ASSESSMENTS AND RESPONSE ACTIONS**

The EPA QA Manager or designee may conduct an audit of the field activities for this project. The auditor will have the authority to issue a stop work order upon finding a significant condition that would adversely affect the quality and usability of the data. The EPA TM will have the responsibility for initiating and implementing response actions associated with findings identified during the site audit. The actions taken may also involve the EPA Project Manager and/or Contracting Officer. Once the response actions have been implemented, the EPA QA Manager or designee may perform a follow-up audit to verify and document that the response actions were implemented effectively. In-house audits performed by the START may be conducted in accordance with the START QMP (Weston 2003). No audits are planned for the Musick Mine PA/SI.

If major deviations from the QA requirements of the project and the analytical methods were observed during the data validation process, Weston will request that the EPA QA Manager contact the laboratory to correct the problem. A brief narrative will be written explaining the contract deviations and recommendations will be given based on the quality of the submitted data. If required, re-sampling and subsequent re-analysis will be decided by the TM.

Additional sampling for corrective actions and/or any addendum to this SQAP shall be documented using the Corrective Action Form and the Sample Plan Alteration Form (Appendix B).

#### **3.2 REPORTS TO MANAGEMENT**

Debriefing of the EPA TM occurs by the START Site Leader on a daily basis. Laboratory deliverables will be generated according to CLP Statement of Work (SOW) guidelines. Once the project is complete and the resulting data is obtained, the START PM will assist the Site Leader in preparation of a final project report. The report will include a summary of the activities performed during the project and the resulting data (along with any statements concerning data quality). The report will be approved by the EPA TM prior to forwarding to the individuals identified in the distribution list located in the Table of Contents section of this SQAP.

The START corrective action program is addressed in Section 3 of the QMP (Weston 2003). Corrective actions will be conducted in accordance with these QMP specifications.

## SECTION 4

### DATA VALIDATION AND VERIFICATION

The data review and validation of data packages will include an evaluation of: the information provided on the analytical data sheets and required support documentation for all sample analyses; the supporting sample collection documentation, including chain-of-custody; and field instrument calibration, results, and/or performance check documentation (if required by the method). The QA review will also examine adherence to the procedures as described in the cited SOPs and the specified analytical methods in the SQAP.

#### 4.1 DATA VALIDATION

Analytical data generated by CLP will be reviewed by Region 10 QA Unit. Analytical data generated by MEL will be reviewed by MEL or its designee. Analytical Data generated by a commercial laboratory will be reviewed by Weston. The data reviews will be performed on a regular two-week turn around time that starts upon receipt of the complete analytical data package from the laboratory or its designee. All of the data reviews will be performed in accordance with the QA/QC requirements specified in the SQAP, the technical specifications of the analytical methods, and the EPA CLP National Functional Guidelines for Inorganic Data Review (EPA 2002) and EPA CLP National Functional Guidelines for Organic Data Review (EPA 1999). All data will be validated against project DQOs by Weston.

Validation deliverables will include a QA summary discussing QA conformance and deviations issues that may have affected the quality of the data. Data usability, bases of application of qualifiers and percentage of qualified data will also be discussed in the QA memo. Forms I (Analysis Data Sheet or equivalent) with the applied validation qualifiers and bias determination for estimated-qualified values also will be a part of the validation deliverables. The following qualifiers shall be used in the data validation:

- U — The compound was analyzed for, but not detected.
- UJ — The compound was analyzed for, but was not detected; the associated quantitation limit is an estimate because quality control criteria were not met.
- J — The analyte was positively identified, but the associated numerical values is an estimated quantity because quality control criteria were not met or because concentrations reported are less than the CRQL or lowest calibration standard but above MDL.
- R — Quality control indicates that data are unusable for any purpose (compound may or may not be present). Resampling and reanalysis are necessary for verification.
- B — Detected concentration is above the method detection limit, but below the CRQL (inorganics only).
- H — High bias.



K — Unknown bias.

L — Low bias.

## **4.2 DATA VERIFICATION**

Data review deliverables will be submitted to Weston for validation and verification. Using the QA memo, the Forms I (or equivalent) with data qualifiers and the electronic data deliverables (EDDs) from the laboratories, Weston will ensure that consistency exists among three documents. Weston will ensure that the appropriate data and bias qualifiers are applied to the affected values on the Forms I and EDDs as specified on the QA memo submitted by the reviewer.

## **4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES**

The data quality indicator targets for this project are discussed in Section 1.4 of this SQAP. The data validation will be used as a tool to determine whether these targets were met. Also, using the compiled data, Weston and TM will determine variability and soundness of the data and the data gaps that will need to be filled to meet the objectives of the project. Preliminary ranking of the site also will be determined if additional sampling is needed for the site.

## SECTION 5

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## **APPENDIX A**

### **STANDARD OPERATING PROCEDURES**

1. RFW/R10-001 Standard Operating Procedure for Surface and Subsurface Soil Sampling
2. RFW/R10-003 Standard Operating Procedure for Sediment Sampling
3. RFW/R10-004 Standard Operating Procedure for Surface Water Sampling

**STANDARD OPERATING PROCEDURE  
FOR  
SURFACE AND SUBSURFACE  
SOIL SAMPLING**


Prepared by:

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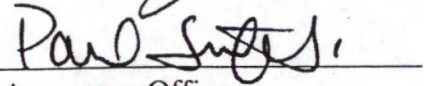
12 November 2002

EPA Contract No. 68-S0-01-02

**APPROVALS**

Reviewed by:   
Site Assessment Project Manager

Date: 12 Nov 02

Approved by:   
Quality Assurance Officer

Date: 11/12/2002



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## 1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures by which Weston Solutions, Inc. (Weston), Region X Superfund Technical Assessment and Response Team (START) personnel will collect representative surface and subsurface soil samples. The purposes for the collection and analysis of soil samples will be detailed in site-specific Sampling and Quality Assurance Plans (SQAPs) and may include: determining whether concentrations of hazardous substances in soils exceed established action levels, confirming or identifying hazardous substances that may have impacted the environment, determining if contaminants are migrating off site, or determining if the contaminants are present at concentrations that may present a risk to public health, welfare, or the environment.

## 2.0 Summary of Method

Soil samples (surface and subsurface) may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils (0 - 2 feet) may be easily sampled using a trowel, scoop, or spade. Sampling at greater depths may be performed using a hand auger, Geoprobe, drill rig split spoon, or excavator. Techniques for collecting subsurface soil samples using a Geoprobe are discussed in a separate SOP entitled, *Collection of Soil, Soil Gas, and Groundwater Samples Using a Direct Push Sampling System*. Subsurface samples collected during drilling activities using a 2-inch split spoon and subsurface samples collected during excavation activities are discussed in specific Requests For Proposal (RFP) prepared by START during the procurement process.

## 3.0 Acronym List

cc	-	Cubic Centimeters
CLP	-	Contract Laboratory Program
DAS	-	Delivery of Analytical Services
DOT	-	Department of Transportation
Dupl	-	Duplicate
EPA	-	U.S. Environmental Protection Agency
ERRS	-	Emergency Rapid Response Services
FID	-	Flame Ionization Detector
ft <sub>2</sub>	-	Square Foot
GPS	-	Global Positioning System
HASP	-	Health and Safety Plan
HCl	-	Hydrochloric Acid
HNO <sub>3</sub>	-	Nitric Acid
IATA	-	International Air Transport Association
ml	-	milliliter
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate



NaOH	-	Sodium Hydroxide
OSHA	-	Occupational Safety and Health Administration
PE	-	Performance Evaluation
pest/PCB	-	Pesticide/Polychlorinated Biphenyl
PID	-	Photoionization Detector
PPE	-	Personal Protective Equipment
ppm	-	Parts per million
PRP	-	Potentially Responsible Party
QAPP	-	Quality Assurance Project Plan
QA/QC	-	Quality Assurance/Quality Control
RFP	-	Request for Proposal
SDG	-	Sample Delivery Group
SOP	-	Standard Operating Procedure
SQAP	-	Sampling and Quality Assurance Plan
START	-	Superfund Technical Assessment and Response Team
SVOC	-	Semivolatile Organic Compound
TDD	-	Technical Direction Document
VOA	-	Volatile Organic Analysis
VOC	-	Volatile Organic Compound
Weston	-	Weston Solutions, Inc.

#### **4.0 Health and Safety Warnings**

START personnel performing work on hazardous waste sites will follow Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), and Weston/START specific health and safety procedures and protocols. START personnel conducting on-site soil sampling activities will also be performing tasks in accordance with EPA-approved sampling QAPPs, and Operating Practices prepared and approved by START.

In order to ensure the safety of personnel during sampling activities, the buddy system, periodic air monitoring, and caution will be used throughout field activities. To minimize risks due to chemical exposure, dermal and respiratory protection may be required if air monitoring equipment indicates that the environment is unsafe. Field activities will follow the site HASP, which further addresses the safety considerations of the property. Hazards identified in or around the site may include physical hazards (slips, trips, and falls). Additional potential hazards exist in association with drilling and excavation activities; therefore, START and its subcontractors will utilize the Weston Drilling Safety Guide and will follow industry standards and protocols for all activities involving drill rigs or similar apparatus for the purpose of soil boring and excavation activities.

For any field assignments involving the collection of subsurface samples, excavation, or any other type of intrusive activities, it is a legal requirement to call the appropriate utility clearance center before beginning any intrusive activities on site. The Utilities Underground Location Center telephone number for Washington and Oregon is 1-800-424-5555; the frequent user ID# is 9772. The Utilities Underground Location Center requires two (2) business days advance notification for activities in Washington, and 48 hours advance notification for activities in Oregon. The Alaska



Locate Call Center phone number is 1-800-478-3121; advance notification time requirements in Alaska vary with the location. Idaho public utilities require two (2) business day advance notification and are covered by four different numbers as follows:

- Bonner, Boundary, Latah, and Clearwater counties - Utilities Underground Location Center: 1-800-424-5555
- Kootenai County - Password Inc.: 1-800-428-4950
- Shoshone and Benewah counties: 1-800-398-3285
- Nez Perce and Idaho counties, and all other counties to the south - Dig Line Utility Protection Service of Idaho: 1-800-478-3121

When START procures the services of a drilling or excavation subcontractor, the subcontractor is required to notify the appropriate utility locate center.

The samples collected at the site will be transported to predesignated Contract Laboratory Program (CLP) and/or Delivery of Analytical Services (DAS) laboratories according to either Department of Transportation (DOT) Hazardous Materials Regulations or International Air Transport Association (IATA) Dangerous Goods Regulations, or hand-delivered to the predesignated laboratories. Samples will be transported in a manner that will maintain their integrity, as well as protect against detrimental effects from sample breakage or leakage. Weston's *Manual of Procedures for Shipping and Transporting Dangerous Goods* will be followed whenever samples are shipped.

Decontamination wastes will be collected and secured on site. Separate containers will be used for the aqueous wastes and for flammable, non-chlorinated solvents (methanol and hexane) wastes. Proper personal protection will be worn during decontamination procedures and will include gloves, eye protection, and splash-resistant protective clothing. Off-site disposal of decontamination wastes and contaminated Personal Protective Equipment (PPE) will be conducted through the Subcontract Agreement established by Region X START for disposal of investigation-derived wastes. Non-contaminated wastes will be tightly sealed, double-bagged, and disposed of appropriately.

## 5.0 Interferences

Some interferences or potential problems associated with soil sampling include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

## **6.0 Personnel Qualifications**

Training of START members will be provided to ensure that technical, operational, and quality requirements are understood. START personnel are trained in-house to conduct surface and subsurface soil sampling activities. Training includes reviewing this SOP and other applicable SOPs and/or guidance documents; health and safety training; and “hands-on” experience conducting sampling activities with more experienced START personnel, and performing instrument calibrations. Operation of the Geoprobe is performed by more qualified START personnel who have received training by the manufacturer and have assisted qualified Geoprobe operators during several sampling events. Subsurface soil sampling performed by split spoons on a drill rig are monitored by a START Geologist or other qualified member having extensive experience in drilling operations.

## **7.0 Apparatus and Materials**

Equipment/materials for collecting soil samples includes, but is not limited to, the following:

- Site-specific SQAPs
- Standard Operating Procedure for Surface and Subsurface Soil Sampling
- Safety equipment specified in the site HASP
- Field map of site
- Log book
- Field data sheets (e.g. boring logs, soil description sheets, etc.)
- Graph paper
- Tape measure
- Survey stakes
- Compass
- Survey stakes or flags (white)
- Camera and film
- Continuous flight (screw) auger
- Continuous flight auger extension rods
- Spatula, scoops, or trowel
- Bucket auger
- Post hole auger
- Thin-wall tube sampler
- T-handle
- Stainless steel homogenization bucket or bowl
- Spade or shovel
- Sampling jars
- Spade or shovel
- Decontamination fluids (supplies)/equipment (pump sprayers, brushes, etc.)
- Plastic sheeting (Visqueen)
- Plastic tubs
- Sealable plastic bags
- Labels



- Chain-of-custody forms and seals
- Coolers and ice
- Vermiculite
- Strapping tape

### **7.1 Reagents**

Preservation solutions for rinsate blanks include the following: nitric acid (HNO<sub>3</sub>), sodium hydroxide (NaOH), and hydrochloric acid (HCl).

## **8.0 Method Calibration**

This section is not applicable to this SOP.

## **9.0 Sample Collection**

### **9.1 Preparation**

Following EPA approval of the site-specific QAPPs, and prior to conducting sampling activities, a pre-sampling meeting will be held by START team members to discuss the proposed sampling strategy and site health and safety issues. Attendees of the pre-sampling meeting will include the Project Manager, Site Leader, samplers, and the START Health and Safety Officer. During the pre-sampling meeting, the Site Leader will discuss the site history, contaminants of concern, sampling methodology, individual responsibilities, sample shipment or delivery, health and safety issues, and lines of communication anticipated during the sampling event.

Prior to mobilizing to the site to conduct sampling activities, the START Site Leader will fill out an equipment/supply list and transmit the list to the Weston Equipment Stores technician one week prior to the sampling event. Necessary sampling equipment, sample containers, PPE, and vehicles are therefore reserved. CLP and/or DAS laboratories are also procured or secured one week prior to the sampling by the Lead Chemist.

### **9.2 Surface Soil Sample Collection**

Prior to conducting any on-site activities, START members will review and sign the site-specific HASP. The START field team will establish a command post upwind of suspected source areas, if possible. START members will perform calibration checks of air monitoring instruments and document background ambient air monitoring levels. The samplers will decontaminate the sampling equipment. Decontamination will be conducted in accordance with the HASP, applicable SOPs, and/or the RFPs for drilling or excavation services. Decontamination generally consists of an alconox and water wash followed by a distilled water rinse, followed by an isopropanol rinse, followed by a de-ionized water final rinse, and air drying. Additionally, where high concentrations of specific substances are anticipated,



chemicals such as methanol, hexane, and/or HNO<sub>3</sub> may be used in the decontamination process. In cases where a driller has been procured by START to advance borings and install monitoring wells, the drilling equipment utilized for the completion of soil borings and installation of monitoring wells will be pressure washed before and after daily sampling activities and at each sample location, then further decontaminated in accordance with the decontamination procedure specified in the site-specific sampling plan and HASP. Excavation equipment will also be decontaminated before and after daily sampling activities and at each sample location utilizing a pressure washer, then further decontaminated in accordance with the decontamination procedure specified in the site-specific sampling plan and HASP. Equipment decontamination fluids, and PPE generated during sampling activities will be containerized and disposed appropriately based on the results of laboratory analyses of samples collected.

The number of surface soil samples and the sample locations are described in the approved site-specific QAPP. Under the Removal Program, surface soil samples are generally collected to determine if any hazardous substances are present on site at such concentrations that a removal action is warranted; to determine the extent of contamination; or to ensure that clean up levels are achieved during removal actions. Under the Removal Program, surface soil samples are generally collected at a depth ranging between 0 and 6 inches. Under the Site Assessment Program, surface soil samples are generally collected to determine if concentrations of hazardous substances exceed background levels and can be used to define areas of observed contamination under the Hazard Ranking System. Under the Site Assessment Program, surface soil samples are generally collected at depths ranging between 0 and 24 inches.

### **9.2.1 Grab Sampling**

Surface soil samples will be collected over a surface area of 1 square foot (ft<sup>2</sup>) per sample station. Prior to any sample collection, any extraneous material considered to be not relevant for sample analysis will be removed from the top layer of the sample with a pre-cleaned spade. A thin layer of soil from the area which came in contact with the spade will be removed and discarded using a pre-cleaned, stainless steel scoop, spoon, or trowel. The following section discusses collecting surface soil samples for typical parameters under the START Program.

VOC Sampling - The proper collection of a sample for VOC (including gasoline-range organics) analysis requires minimal disturbance of the sample to minimize loss of volatile compounds from the sample. If volatile organic analysis is to be performed, soil samples will be collected first using a dedicated sampling spatula and placed directly into the appropriate size, prelabelled glass sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

AK101 Sampling - Samples collected for gasoline-range organics analysis by Alaska Method AK101 will be collected following VOC sample collection using a dedicated



coring device (such as a 15-ml syringe with its tip removed). The coring device will be used to transfer a predetermined amount of soil from the sample location into a pre-weighed sample container (provided by the laboratory). The approximate weight of sample required is determined by the laboratory and is typically 25 grams. The weight of sample placed in the container will be determined by placing the empty container on a portable electronic scale, zeroing the scale readout, and extruding the sample from the coring device into the container. Practice runs will be performed prior to sampling to determine how far the coring device should be filled to provide the correct amount of sample in a single event. The weight of sample placed in the container will be within  $\pm 3$  grams of the required weight. If the coring device is not suitable because of the soil type (e.g., fibrous peat or large gravel), the sample will be transferred using a dedicated stainless steel teaspoon. 25-mL aliquots of methanol will be carefully added to the container until the sample is submerged. As the container is pre-weighed at the laboratory, no additional sample labels, tape, or custody seals will be affixed to the sample container. Appropriate sample information will be written on the label affixed to the container by the laboratory.

To increase the data reliability and reproducibility, it is desirable to manually homogenize the soil sample. After the VOC fraction of soil is collected, additional soil samples will be placed into a stainless-steel bowl or other appropriate homogenization container, and mixed thoroughly to obtain a homogenous sample representative of the entire sampling interval. A dedicated sampling spatula will be used to collect the sample material and place it into the appropriate sample container (preferably a wide-mouth container). Dedicated spatulas are used to prevent the possibility of cross-contamination between sample stations as well as to eliminate the need for any decontamination procedures. The container cap will then be secured, and the sample will be preserved by immediately placing containers in a cooler with ice.

In cases where split samples will be collected, an adequate amount of sample volume must be homogenized to account for the extra samples. Split samples will be used in situations where confirmation samples will be submitted to an analytical laboratory to verify on-site screening results, or an aliquot is requested by the potentially responsible party (PRP). The following section discusses collecting surface soil samples for typical parameters following homogenization of the sample.

Semivolatile Organic Compound (SVOC) Sampling - Surface soil samples will be collected using a dedicated sampling spatula as described above and placed into the appropriate size, prelabelled glass sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Pesticides/Polychlorinated Biphenyl (Pest/PCB) Sampling - Surface soil samples will be collected using a dedicated sampling spatula as described above and placed into



the appropriate size, prelabelled glass sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Metals Sampling - Surface soil samples will be collected using a dedicated sampling spatula as described above and placed into the appropriate size, prelabelled sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Cyanide Sampling - Surface soil samples will be collected using a dedicated sampling spatula as described above and placed into the appropriate size, prelabelled sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Asbestos Sampling - Discrete soil samples will be collected from the homogenized sample using a dedicated sampling spatula as described above and placed into the appropriate size, prelabelled sample container.

### **9.2.2 Composite Sampling**

Compositing samples is a useful technique to provide an average concentration of contaminants over a certain number of sampling points. The technique reduces both the number of required laboratory analyses and the sample variability. If sampling points are non-homogeneous, compositing dilutes high concentration aliquots; therefore, detection limits should be considered carefully when choosing the number of aliquots to composite (the compositing factor). The compositing factor (e.g., 3 to 1; 10 to 1) and the aliquots selected for inclusion in the compositing factor will be determined by EPA prior to sampling and will be recorded on the chain-of-custody documentation (e.g., composite, sampling stations 1-4) and in the site-specific QAPP. Detection limits need not be considered if the composite area is assumed to be homogeneous in concentration.

Compositing requires that each discrete aliquot be the same in terms of volume or weight, and that each of the aliquots be thoroughly homogenized. The detection limit of the analysis to be performed and the selected action level must be considered when choosing a compositing factor for non-homogeneous sample points. For example, if the chosen action level is 10 parts per million (ppm) in the soil and five aliquots are composited, then the action limit of the composite is 10 ppm divided by five, or 2 ppm. The detection limit of the analysis must be 2 ppm or lower in order to determine if the action limit has been exceeded in any one aliquot.

Sample aliquots of equal volume or weight will be manually homogenized inside of a stainless steel bowl using a stainless steel scoop or inside of a disposable pan using a disposable scoop. The sample is then quartered and split five times or until the sample is thoroughly homogenized. The homogenized sample is then placed into the



appropriate size, prelabelled container (preferably a wide-mouth container) for each analyses to be performed. The container cap will then be secured and the sample will be preserved by immediately placing containers in a cooler with ice.

Compositing is **not** recommended when/where VOCs are the contaminants of concern. Homogenization will result in the potential loss of the target compounds. If homogenization is required, it will be done on samples that are preserved in the field. Equal volumes (ccs) of soil will be placed in the same pre-preserved jar.

### **9.3 Subsurface Soil Sample Collection**

The number of subsurface soil samples, sample locations, and depths are described in the approved site-specific QAPPs. Under the Removal Program, subsurface soil samples are generally collected to determine if any hazardous substances are present on site at such concentrations that a removal action is warranted; to determine the extent of contamination; or to ensure that clean up levels are achieved during removal actions. Subsurface soil samples discussed in this section are those samples collected at depths greater than 6 inches. Under the Site Assessment Program, subsurface soil samples are collected to identify potential sources that may be used to determine attribution. Subsurface samples are those collected at depths greater than 2 feet.

Prior to conducting any on-site activities, START members will review and sign the site-specific HASP. The START field team will establish a command post upwind of suspected source areas, if possible. START members will perform calibration checks of air monitoring instruments and document background ambient air monitoring levels. The samplers will decontaminate the sampling equipment. Decontamination will be conducted in accordance with the HASP, applicable SOPs, and/or the RFP for drilling or excavation services. Decontamination generally consists of an alconox and water wash followed by a distilled water rinse, followed by an isopropanol rinse, followed by a de-ionized water final rinse, and air drying. Additionally, where high concentrations of specific substances are anticipated, reagents such as methanol, hexane, and/or nitric acid may be used in the decontamination process. In cases where a driller has been procured by START to advance borings and install monitoring wells, the drilling equipment utilized for the completion of soil borings and installation of monitoring wells will be pressure washed before and after daily sampling activities and at each sample location, then further decontaminated in accordance with the decontamination procedure specified in the site-specific sampling plan and HASP. Excavation equipment will also be decontaminated before and after daily sampling activities and at each sample location utilizing a pressure washer, then further decontaminated in accordance with the decontamination procedure specified in the site-specific sampling plan and HASP. Equipment decontamination fluids, and PPE generated during sampling activities will be containerized and disposed appropriately based on the results of laboratory analyses of samples collected.



Subsurface soil samples will be collected over a surface area within a 6-inch radius around the sample point per sample station. Prior to any sample collection, the surface area at the sample location will be cleared of any extraneous material considered to be not relevant for sample analysis. It may be advisable to remove the first 3 inches of surface soil from the approximately 6-inch radius around the sampling location.

### **9.3.1 Sample Collection Procedures for Auger and Thin-Wall Sampling**

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler. The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the soil at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several types of augers are available. These include the following: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. The continuous flight augers are satisfactory for use when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil.

The area to be sampled is cleared of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the sampling location. When clearing has been completed, the assembled auger is bored into the soil. The sampler begins augering, periodically removing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

Upon reaching the desired sampling depth, the auger is slowly and carefully removed from the boring. When sampling directly from the auger, the sample is collected after the auger is removed from the boring. Once removed from the bore hole, the top inch of the sample core is removed and discarded. The remaining core is placed into a stainless steel bowl (or disposable pan) where it is homogenized (**except for VOCs**) using a stainless steel (or disposable) scoop. Any extraneous material not considered to be relevant for analysis is removed from the sample during homogenization. The sample is then placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis to be performed. The container cap(s) will then be secured, and the samples will be preserved by



immediately placing the containers in a cooler on ice. If VOC analysis is to be performed, soil samples will be collected directly from the auger using a dedicated sampling spatula and placed directly into the appropriate size, prelabelled glass sample container. For AK101 sample collection (described in Section 9.2.1), the sample coring device will be inserted directly into the tip of the auger bucket. All samples collected will be preserved by placing the sample container in a cooler with ice.

To increase the data reliability and reproducibility, it is desirable to manually homogenize the soil sample. After the VOC fraction of soil is collected, additional soil sample will be placed into a stainless-steel bowl or other appropriate homogenization container, and mixed thoroughly to obtain a homogenous sample representative of the entire sampling interval. A dedicated sampling spatula will be used to collect the sample material and place it into the appropriate sample container (preferably a wide-mouth container). Dedicated spatulas are used to prevent the possibility of cross-contamination between sample stations as well as to eliminate the need for any decontamination procedures. The container cap will then be secured, and the sample will be preserved by immediately placing containers in a cooler with ice.

In cases where split samples will be collected, an adequate amount of sample volume must be homogenized to account for the extra samples. Split samples will be used in situations where confirmation samples will be submitted to an analytical laboratory to verify on-site screening results, or an aliquot is requested by the PRP.

To use the thin-wall tube sampler, the auger tip is removed from drill rods and replaced with a pre-cleaned thin-wall tube sampler. The proper cutting tip is installed, and the tube sampler is carefully lowered down the borehole. The tube sampler is gradually forced into the soil. Care should be taken to avoid scraping the borehole sides. Hammering the drill rods to facilitate coring should be avoided as the vibrations may cause the boring walls to collapse. The tube sampler is removed, the drill rods unscrewed, and the cutting tip and the core removed from the device. The top of the core (approximately 1 inch), is discarded as this represents material collected before penetration of the layer of concern. The remaining core is placed into the appropriate labeled sample container(s).

Procedures for collecting samples for VOCs analysis, as well as other parameters, are similar to those described in the preceding section. Procedures for homogenizing soil samples, and collecting split and composite subsurface soil samples are also similar to those described in the preceding section.

If another sample is to be collected in the same hole, but at a greater depth, the auger bit is reattached to the drill and assembly, and the process is repeated, making sure to decontaminate the auger and tube sampler between samples. The boring is then



abandoned according to applicable state regulations. Generally, shallow holes (less than 2 feet deep) can simply be backfilled with the removed soil material.

### **9.3.2 Sample Collection Procedures for Split Spoon Sampling**

During the advancement of borings, split spoon sampling is one of the standard ways of collecting subsurface samples in unconsolidated materials. START procures the services of a qualified driller via an RFP to perform this service. The RFP details the Scope of Work for the site and is divided into technical, administrative, health and safety, and general requirements. Since geologic information is recorded during this activity, a START Geologist or qualified member will be assigned to the project.

The number of subsurface soil samples, sample locations, and depths are described in the site-specific QAPP. Prior to conducting any on-site activities, START members will review and sign the site-specific HASP. The START field team will establish a command post upwind of suspected source areas, if possible. START members will perform calibration checks of air monitoring instruments and document background ambient air monitoring levels. The samplers will decontaminate the sampling equipment. Decontamination will be conducted in accordance with the HASP, applicable SOPs, and the RFP for drilling services. Decontamination generally consists of an alconox and water wash followed by a distilled water rinse, followed by an isopropanol rinse (for visibly or otherwise obviously contaminated samples), followed by a de-ionized water rinse.

Decontamination and containment materials will be supplied by the drilling subcontractor and included in the proposal. Drilling activities will be organized to minimize contamination of equipment, and the drilling subcontractor will be responsible for decontaminating all equipment prior to use at the site. The drilling subcontractor will be responsible for decontaminating the split spoons, after each boring and upon leaving an exclusion (i.e., potentially contaminated) zone, or at the discretion of START. A vehicle and equipment decontamination area will be established by the drilling subcontractor. The Subcontractor will be required to follow START's instructions for the proper decontamination of vehicles and equipment. Decontamination water will be collected in drums, provided by the drilling subcontractor, at the vehicle and equipment decontamination area for subsequent disposal.

Decontamination of the drill rigs and accessories between borings will consist of removing loose soil from the tracks, augers, casing, and drill rods and rinsing by using a pressure washer. All extracted materials will be decontaminated by the drilling subcontractor prior to disposal with the steam and/or pressure washer.

Additionally, split spoon sampling devices will be rinsed between samples using non-phosphate detergent followed by a clean water rinse and a distilled/deionized water



rinse. All decontamination rinsate will be containerized in 55-gallon steel drums or a larger tank. The drilling subcontractor shall be responsible for providing all necessary decontamination materials, including a water supply (minimum of 500 gallons). In addition, START will provide decontamination fluids and applicators to be used on the split spoons between sampling intervals at the same boring location.

Core samples (of a 2-foot length) are typically collected at intervals of 5 feet, beginning at the 0-foot to 2-foot interval and thereafter (i.e. 5 to 7 feet, 10 to 12 feet, 15 to 17 feet, etc.). Prior to any sample collection, the surface area at the sample location will be cleared of any extraneous material considered to be not relevant for sample analysis. Generally, a 2-inch outside diameter, 2-foot long split spoon (with a spoon trap) is driven by a 140-pound weight dropped through a 30-inch interval [a 3-inch outside diameter split spoon is sometimes used when a large volume of soil is required. Diameters of the split spoons will be determined prior to sampling and specified in the site-specific QAPP]. The number of blows required to drive the split-spoon sampler provides an indication of the compaction/density of the soils being sampled. The split spoon is attached to the end of the drill rods, and the 0-foot to 2-foot interval split spoon is driven to the desired depth. The number of blows required to advance the split spoon each 6 inches for the 2-foot interval is recorded in the site log book or on field data sheets by START. Upon reaching the desired sampling depth, the split spoon is slowly and carefully extracted from the boring.

Once the split spoon is removed from the drill rods, the split spoon will be placed on plastic sheeting in a horizontal position and opened by unscrewing the bit and head and splitting the barrel. A photoionization detector (PID) or flame ionization detector (FID) will be used to screen the sample as soon as the split spoon is opened. Sampling intervals will either be predetermined or decided in the field based on elevated field screening levels on the PID or FID, or based on visual observations. If samples will be collected for VOC analysis, VOC samples will be immediately collected using a dedicated sampling spatula and placed directly into the appropriate size, prelabelled glass sample container. For AK101 samples, the coring device will be inserted directly into the soil contained in the split spoon. All samples will be preserved by placing the sample container in a cooler with ice.

The length of the recovered core will be recorded in the site log book or on field data sheets by START. START will describe the soil in the split spoons using the Unified Soil Classification System. If hydrocarbon (e.g., gasoline) contamination is suspected, then headspace analysis will be performed as outlined in SOP, entitled *Standard Operating Procedures For Jar Headspace Screening*.

After collecting VOC samples and conducting headspace screening, the sample material is placed into a stainless steel bowl where it is homogenized using a stainless steel (or disposable) scoop. Any extraneous material not considered to be



relevant for analysis is removed from the sample(s) during homogenization. The sample is then placed into the appropriate size, prelabelled sample containers for each analysis (e.g., SVOCs, pest/PCBs, metals, cyanide, asbestos, etc.) to be performed. The container cap(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice.

The driller will then advance the borehole to a depth of 5 feet using the drilling method as specified in the RFP. The drill rods will be withdrawn, and a clean (decontaminated) split spoon will be attached and lowered to the bottom of the borehole until it rests on top of the undisturbed soil. In order to obtain representative soil samples, the bottom of the borehole must be clean and the soil to be sampled must be undisturbed. The split spoon will be driven to the desired depth (5 - 7 feet), and the number of blows required to advance the split spoon each 6 inches for the 2-foot interval will be recorded in the site log book or on field data sheets by START. The split spoon will be slowly and carefully extracted from the boring. START will measure the length of the recovered core, describe the soil in the split spoons, and collect soil for headspace screening.

Drilling will continue until the desired total depth of the boring is reached. A monitoring well will be constructed in the borehole or the borehole will be properly plugged according to state regulations or guidance. START will document monitoring well construction details and/or plugging processes in the site log book or on field data sheets. The driller will decontaminate downhole drilling equipment between sample locations and prior to demobilizing from the site.

If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in diameters of 2 and 3½ inches. However, in order to obtain the required sample volume, use of a larger barrel may be required.

### **9.3.3 Geoprobe Soil Sample Collection Procedures**

Subsurface soil samples may be collected using the geoprobe systems soil probing machine. This is a truck-mounted, piston-driven device which can be used to collect split-spoon samples, install microwells, collect groundwater samples, and conduct soil gas surveys. START has prepared a separate SOP, entitled *Standard Operating Procedures For Sample Collection Procedures using the Geoprobe Systems Soil Probing Machine*, detailing this procedure. This SOP should be reviewed prior to collecting any samples with this method.

### **9.3.4 Test Pit/Trench Excavation Sample Collection Procedures**

START may collect subsurface soil samples during test pit excavation activities. Test pits are typically excavated at sites where it is suspected that buried metal



drums, tanks, and/or containers suspected of containing hazardous materials may be present, following geophysical surveys (terrain conductivity and magnetometer) conducted by START or other third parties.

Qualified excavation subcontractors are either procured by START via an RFP or by EPA's Emergency Rapid Response Services (ERRS) contractor to perform this service. When these services are procured by START, the details of the Scope of Work for the site are divided into technical, administrative, health and safety, and general requirements.

Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of utility lines and poles (subsurface as well as above surface). During excavation activities, decontamination and containment materials will be supplied by the excavation subcontractor. Excavation activities will be organized to minimize contamination of equipment. It shall be the responsibility of the excavation subcontractor to decontaminate all equipment prior to use at the site as part of the mobilization activities. The excavation subcontractor will be responsible for decontaminating equipment, tracks or tires, and bucket, after each test pit and upon leaving an exclusion (i.e., potentially contaminated) zone, or at the discretion of START. A vehicle decontamination area will be established by the excavation subcontractor, and the subcontractor will be required to follow START's instructions for the proper decontamination of vehicles and equipment. Decontamination water will be collected in drums, provided by the excavation subcontractor, at the vehicle and equipment decontamination area for subsequent disposal.

Decontamination of the backhoe or excavator between test pits will consist of removing loose soil from the tracks or tires and bucket, and rinsing by using a pressure washer. All extracted materials will be decontaminated by the subcontractor prior to disposal with the pressure washer. The subcontractor will decontaminate equipment between test pit locations and prior to demobilizing from the site.

Test pits afford the opportunity for the detailed examination of soil characteristics (stratification, texture, color, etc.) and to identify potential subsurface soil sample locations. Once sample locations are determined, START will direct the excavation subcontractor to obtain a soil sample using the bucket of the excavator. START will then collect soil samples from an area near the middle of the bucket. If samples will be collected for VOC analysis, VOC samples will be immediately collected using a dedicated sampling spatula and placed directly into the appropriate size, prelabelled glass sample container. For AK101 samples, the coring device will be inserted directly into the soil in the bucket. All samples will be preserved by placing the sample container in a cooler with ice.

After collecting VOC samples and screening for VOCs, the sample material will be placed into a stainless steel bowl and homogenized using a stainless steel (or



disposable) scoop. Any extraneous material not considered to be relevant for analysis will be removed from the sample(s) during homogenization. The sample will then be placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis (e.g. SVOCs, pest/PCBs, metals, cyanide, asbestos, etc.) to be performed. The container cap(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice.

## **10.0 Handling and Preservation**

Trip blanks are used to assess the degree of contamination introduced into samples during sample handling, shipment, and analysis. Contamination may be introduced from the sample bottle, the preservatives used, cross-contamination (in the case of VOCs), or from shipping and handling, both in the field and in the laboratory. Samples are shipped to analytical laboratories expeditiously to ensure that holding times are not exceeded. Chemicals used during the decontamination process, including nitric acid, hexane, methanol, and isopropanol.

## **11.0 Sample Preparation and Analysis**

This section is not applicable to this SOP.

## **12.0 Troubleshooting**

All field screening instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

## **13.0 Data Acquisition, Calculations, and Data Reduction**

### **13.1 Computer Hardware and Software**

Surface soil sample locations and boring locations may be located using a Trimble Pro XRS or GeoExplorer Global Positioning System (GPS) receiver. Prior to conducting field work, Trimble Pathfinder Office 2.51 (Pathfinder software) may be used to generate a data dictionary to be used during collection of sample locations. The data dictionary is then transferred from the computer to the GPS datalogger. Upon returning from the field, GPS data are downloaded from the GPS datalogger to a computer using the Pathfinder software. GPS data undergo differential correction, with base station data obtained from a variety of community base stations depending upon geographic location to improve location accuracy. Pathfinder is used to export GPS data in a variety of formats [i.e. ArcView shapefile, ARC/INFO, dBASE, and AutoCAD export (DXF) files]. Typically, GPS data are exported into dBASE files, and then manipulated with Microsoft Excel 2000 software. Data are then manipulated where they can be utilized in site diagrams to display sample locations.



### **13.2 Data Management and Records Management**

Field observations made during the sampling event will be recorded in a site log book and/or field data sheets, including description of sampling locations and any deviations from the Sampling and Quality Assurance Plan (SQAP) or Task Work Plan. Chain-of-custody will be maintained until samples are relinquished to a courier or to the laboratories assigned to perform the analyses. Photographs will be taken to document site conditions. The location and direction from which photographs are taken will be noted in the field log book, in accordance with the scope of work. Soil borings will be logged by the START on-site geologist, and boring logs will be prepared following site activities. Reports, site file memoranda, figures, tables, boring logs, etc. will be saved in site-specific Technical Direction Document (TDD) directories.

### **14.0 Quality Control and Quality Assurance Section**

This section describes QA/QC pertinent to surface and subsurface soil samples, and the types and uses of the QA/QC samples that are collected in the field. QA/QC samples are analyzed to provide information on the variability and usability of environmental sample results. They assist in identifying the origin of analytical discrepancies to help determine how the analytical results should be used. They are used mostly to validate analytical results.

A data quality review of the laboratory sample analyses will be conducted by U.S. EPA.

Field duplicates (replicates), MS/MSD, trip blanks, rinsate (equipment) blanks, and temperature blanks are discussed below. QA/QC results may suggest the need for modifying sample collection, preparation, handling, or analytical procedures if the resultant data do not meet quality assurance objectives.

#### **14.1 Field Duplicates**

Field duplicates are used to assess the degree of sample homogeneity, and the reproducibility of the sample collection procedure and the laboratory analysis. Field duplicates are typically collected with surface soil and subsurface soil samples which are submitted for field screening analysis or for site assessment scoring activities. One field duplicate is typically collected for each matrix type and sample parameter for every 20 stations. The field duplicate is assigned an individual sample number.

#### **14.2 Laboratory Matrix Spike and Matrix Spike Duplicate**

MS and MSD samples are used to monitor laboratory performance. MS/MSD samples are spiked in the laboratory with a known concentration of a target analyte(s) to verify percent recoveries. It may be necessary to provide extra volume of a sample to the laboratory for spiking analyses. Extra volume for MS/MSD or MS/Duplicate (Dupl) analyses is collected for every 20 samples of each matrix for each requested analytical parameter.



For surface soil and subsurface soil samples, extra volume is collected, homogenized thoroughly, and divided by alternately scooping the homogenized sample into two separate bottles. The exception occurs when collecting for VOC analysis, where extra VOC samples are collected immediately. The MS/MSD samples are assigned the same sample number.

### **14.3 Trip Blanks**

Trip blanks are used to assess the degree of contamination introduced into samples during sample handling, shipment, and analysis. Contamination may be introduced from the sample bottle, the preservatives used, cross-contamination (in the case of VOCs), or from shipping and handling, both in the field and in the laboratory. Trip blanks are typically collected for VOC analysis. Trip blanks (organic-free water) will be collected prior to the sampling event. Each bottle of the trip blank sample will be preserved with one drop of 1:1 HCl per 20 ml of sample to achieve a pH < 2. Trip blanks are handled, transported, and analyzed in the same manner as the other samples collected for that analysis that day. One set of trip blanks is collected for VOC analysis for each cooler in which VOC samples are shipped.

### **14.4 Rinsate (Equipment) Blanks**

Dedicated or decontaminated sampling equipment will be used at each surface and/or subsurface sample location to minimize cross-contamination. Surface and subsurface sampling equipment must be decontaminated prior to the start of sampling activities as well as between sample locations, unless the sampling activity is dedicated to one sample location. Rinsate blanks are used to assess contamination (typically, cross-contamination) brought about by improper decontamination procedures between sampling stations. Rinsate blanks are not required for dedicated, disposable sampling implements. Examples of equipment requiring decontamination and rinsate blanks include augers, shovels, split spoons, and stainless steel scoops and mixing bowls.

Rinsate blanks are obtained by running analyte-free water over decontaminated sampling equipment to test for residual contamination. The water is collected into the appropriate sample containers which are handled (e.g., preserved), shipped, and analyzed identical to the samples collected that day. Where non-dedicated sampling equipment is used, rinsate blanks must be collected at the rate of one per 20 stations for each type of sampling equipment used.

### **14.5 Temperature Blanks**

Temperature blanks provide information of the preservation (temperature) of the samples during shipment to the laboratories. Temperature blanks are obtained by pouring tap water into a 40-ml glass vial and placing one temperature blank per cooler of samples.

## **15.0 Reference Section**



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**STANDARD OPERATING PROCEDURE  
FOR  
SEDIMENT SAMPLING**

Prepared by:

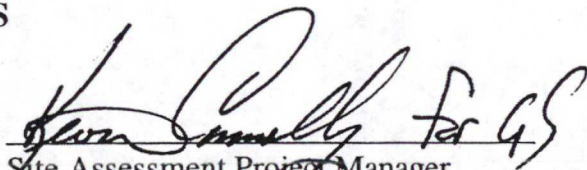
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**APPROVALS**

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## 1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures used by Region X Weston Solutions, Inc. (Weston), Superfund Technical Assessment and Response Team (START) personnel in collecting representative sediment samples. Purposes for the collection of sediment samples by START personnel and their subsequent analysis will be detailed in site-specific Sampling and Quality Assurance Plans (SQAPs), and may include determining whether concentrations of hazardous substances in sediment samples exceed established action levels, confirming or identifying hazardous substances that may have impacted the environment, determining if contaminants are migrating off site, or if the concentrations of hazardous substances may present a risk to public health, welfare, or the environment.

The methodologies discussed in this procedure are applicable to the sampling of sediment in both flowing and standing water. They are generic in nature and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, as well as the constraints presented by the sampling area. However, if modifications occur, they shall be documented in the site logbook or report summarizing field activities.

For the purposes of this procedure, sediments are defined as detrital material located in either static (as in lakes, ponds, wetlands, or other impoundments) or flowing (streams) water bodies. Selection of an appropriate sediment sampling technique is contingent upon the depth of water at the sampling location and the physical characteristics of the sediment to be sampled.

## 2.0 Summary of Method

Sediment samples may be collected using a variety of methods and equipment depending on the depth of the water body layer, the portion of the sediment profile required (surface versus subsurface), the type of sample required (disturbed versus undisturbed), and the sediment type. If surface water samples are to be collected at the same sampling location as the sediment sample, the surface water sample is to be collected first. START has prepared a separate SOP, entitled *Standard Operating Procedure For Surface Water Sampling*. This SOP should be reviewed prior to collecting surface water samples. Sediments collected from a flowing water body (such as a stream) should be collected beginning at the most downstream sampling location, and progressing to the most upstream sampling location. This procedure is followed to collect a representative sediment sample at the sampling location and to avoid sediment cross-contamination caused when sediments are disturbed during the sampling process.

Sediment is collected from a water body either directly using a hand-held device (such as a shovel, trowel, or auger) or indirectly using a remotely activated device (such as an Ekman or Ponar dredge). Following collection, the sediment sample is placed into a decontaminated container such as a stainless steel bowl, homogenized, and placed into appropriate sample containers. Sediment samples should be homogenized only after the portion for volatile organic compound (VOC) analysis has been collected, in order to avoid the loss of VOC contaminants during the homogenization process.



### 3.0 Acronym List

cc	-	Cubic centimeters
CLP	-	Contract Laboratory Program
COC	-	Chain-of-Custody
DAS	-	Delivery of Analytical Services
DOT	-	Department of Transportation
DQOs	-	Data Quality Objectives
EPA	-	U.S. Environmental Protection Agency
GPS	-	Global Positioning System
HASP	-	Health and Safety Plan
IATA	-	International Air Transport Association
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate
OSHA	-	Occupational Safety and Health Administration
PE	-	Performance Evaluation
pest/PCB	-	Pesticide/Polychlorinated Biphenyl
PFO	-	Personal Flotation Device
PPE	-	Personal Protective Equipment
ppm	-	Parts per million
PRP	-	Potentially Responsible Party
QAPP	-	Quality Assurance Project Plan
QA/QC	-	Quality Assurance/Quality Control
RFP	-	Request for Proposal
SDG	-	Sample Delivery Group
SOP	-	Standard Operating Procedure
SQAP	-	Sampling and Quality Assurance Plan
START	-	Superfund Technical Assessment and Response Team
SVOC	-	Semivolatile Organic Compound
TDD	-	Technical Direction Document
TWP	-	Task Work Plan
VOA	-	Volatile Organic Analysis
VOC	-	Volatile Organic Compound
Weston	-	Weston Solutions, Inc.

### 4.0 Health and Safety Warnings

START personnel performing work on hazardous waste sites will follow Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (EPA), and Weston/START specific health and safety procedures and protocols. START personnel conducting on-site and off-site sediment sampling activities will also be performing tasks in accordance with EPA-approved SQAPs, and Operating Practices prepared and approved by START.

In order to ensure the safety of personnel during sampling activities, the buddy system, periodic air monitoring, and caution will be used throughout field activities. To minimize risks due to chemical



exposure, dermal and respiratory protection may be required if air monitoring equipment indicates that the environment is unsafe. Field activities will follow the site health and safety plan (HASP), which further addresses the safety considerations of the property. Hazards identified in or around the site may include physical hazards (slips, trips, and falls). Additional potential physical hazards exist in association with sediment sampling, and may include drowning or exposure due to hypothermia.

When collecting sediment samples from water bodies containing known or suspected hazardous substances, adequate precautions must be taken to ensure the sampler's safety. The START team member collecting the sample should not get too close to the edge of the water where bank failure may cause him or her to lose their balance. The use of personal protective equipment (PPE) and engineering controls, such as safety nets, shall be specified in the site HASP, and shall be based on site-specific conditions. Appropriate PPE may include lifelines or personal flotation devices (PFDs). If sampling from a vessel is required, appropriate protective measures may be required, and shall be detailed in the site HASP.

For any field assignments involving the collection of subsurface samples, excavation, or any other type of intrusive activities, it is a legal requirement to call the appropriate utility clearance center before beginning any intrusive activities on site. The Utilities Underground Location Center telephone number for Washington and Oregon is 1-800-424-5555; the frequent user ID# is 9772. The Utilities Underground Location Center requires two (2) business days advance notification for activities in Washington, and 48 hours advance notification for activities in Oregon. The Alaska Locate Call Center phone number is 1-800-478-3121; advance notification time requirements in Alaska vary with the location. Idaho public utilities require two (2) business day advance notification and are covered by four different numbers as follows:

- Bonner, Boundary, Latah, and Clearwater counties - Utilities Underground Location Center: 1-800-424-5555
- Kootenai County - Password Inc.: 1-800-428-4950
- Shoshone and Benewah counties: 1-800-398-3285
- Nez Perce and Idaho counties, and all other counties to the south - Dig Line Utility Protection Service of Idaho: 1-800-478-3121

The samples collected at the site will be shipped to predesignated Delivery of Analytical Services (DAS) laboratories according to either Department of Transportation (DOT) Hazardous Materials Regulations or International Air Transport Association (IATA) Dangerous Goods Regulations, or hand-delivered to the laboratories. Samples will be transported in a manner that will maintain their integrity, as well as protect against detrimental effects from sample breakage or leakage. Weston's *Manual of Procedures for Shipping and Transporting Dangerous Goods* will be followed whenever samples are shipped.



Decontamination wastes will be collected and secured on site. Separate containers will be used for the aqueous wastes and for flammable, non-chlorinated solvents (methanol and hexane) wastes. Proper personal protection will be worn during decontamination procedures and will include gloves, eye protection, and splash-resistant protective clothing. Off-site disposal of decontamination wastes, purge water, and contaminated personal protective equipment (PPE) will be conducted through the Subcontract Agreement established by Region X START for disposal of investigation-derived wastes. Non-contaminated wastes will be tightly sealed, double-bagged, and disposed of appropriately.

## **5.0 Interferences**

Sediment particle size and organic content are directly related to water velocity and flow characteristics of a body of water. Contaminants are more likely to be concentrated in fine-grained (silts and clays) sediments having a high organic content. In contrast, coarse-grained (sand, pebbles, and cobbles) sediments with low organic content do not typically concentrate pollutants. Therefore, the selection of a sampling location can greatly influence the analytical results.

Some interferences or potential problems associated with sediment sampling include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of non-dedicated sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, inadequate homogenization of the samples, and improper sampling technique for VOC samples, which may result in variable, non-representative results.

For sample matrices such as sediments containing high percent moisture, START routinely provides the analytical laboratory with additional sample volume in order to meet EPA Region X QA analytical guidance that addresses the representativeness of sediment sample matrices. Laboratories must analyze, extract, digest, or distill an increased aliquot of sediment when the sample's percent moisture is equal to or less than 30% solid. Since percent solids are not known until after samples are received by the laboratory, START routinely collects larger sample volumes for each analytical parameter for sediment samples than might be collected for a low-moisture soil sample.

## **6.0 Personnel Qualifications**

Training of START members will be provided to ensure that technical, operational, and quality requirements are understood. START personnel are trained in-house to conduct sediment sampling activities. Training includes reviewing this SOP and other applicable SOPs and/or guidance documents, health and safety training, "hands-on" experience conducting sampling activities with more experienced START personnel, and with instrument calibrations.



## **7.0 Apparatus and Materials**

Equipment/materials for collecting sediment samples includes, but is not limited to the following:

- Site-specific SQAP.
- Standard Operating Procedure for Sediment Sampling.
- Safety equipment specified in the site Health and Safety Plan.
- Field map of site and/or plot plan.
- Logbook.
- Field data sheets (e.g. soil description sheets, etc.).
- Graph paper.
- Tape measure.
- Compass.
- Survey stakes, flags (white), or buoys and anchors.
- Camera and film.
- Continuous flight (screw) auger.
- Continuous flight auger extension rods.
- Spatula, scoops, or trowel.
- Bucket auger.
- T-handle.
- Post hole auger.
- Stainless steel homogenization bucket or bowl.
- Spade or shovel.
- Thin-walled auger.

- Ponar dredge.
  - Ekman dredge.
  - Sediment coring device (tubes, points, drive head, drop hammer, “eggshell” check valve devices, acetate cores).
  - Certified clean sampling containers.
  - Conductivity, turbidity, and temperature meter.
  - pH paper.
  - Decontamination fluids (supplies)/equipment (pump sprayers, brushes, etc.).
  - Plastic sheeting (Visqueen).
  - Plastic tubs.
  - Sealable plastic bags.
- 
- Labels.
  - Chain-of-custody forms and seals.
  - Coolers and ice.
  - Vermiculite.
  - Strapping tape.
  - Nylon rope.

### **7.1 Reagents**

Reagents are not typically used for the preservation of sediment samples. Preservation solutions for rinsate blanks may include: nitric acid, sodium hydroxide, and hydrochloric acid.

## **8.0 Method Calibration**

This section is not applicable to this SOP.



## **9.0 Sample Collection**

Under the Removal Program, sediment samples may be collected to determine if any hazardous substances are present on site at such concentrations that a removal action is warranted; to determine the extent of contamination; or to ensure that clean up levels are achieved during removal actions. Under the Site Assessment Program, sediment samples are generally collected to determine if concentrations of hazardous substances document an observed release to the surface water pathway and can be used to document actual contamination to drinking water supplies (surface water intakes), fisheries (food chain), and/or sensitive environments (wetlands, clean water act-protected bodies, endangered and/or threatened species, etc.) under the Hazard Ranking System.

### **9.1 Presampling Preparation**

Following EPA approval of the site-specific QAPPs, and prior to conducting sampling activities, a pre-sampling meeting will be held by START team members to discuss the proposed sampling strategy and site health and safety issues. Attendees of the pre-sampling meeting will include the Project Manager, Site Leader, samplers, and the START Health and Safety Officer. During the pre-sampling meeting, the Site Leader will discuss the site history, contaminants of concern, sampling methodology, individual responsibilities, sample shipment or delivery, health and safety issues, and lines of communication anticipated during the sampling event.

Prior to mobilizing to the site to conduct sampling activities, the START Site Leader will fill out an equipment/supply list and transmit the list to the Weston Equipment Stores technician one week prior to the sampling event. Necessary sampling equipment, sample containers, PPE, and vehicles are therefore reserved. Analytical services are procured for sediment samples through subcontract DAS laboratories at least one week prior to the sampling event by START analytical staff members under the supervision of the START Lead Chemist.

### **9.2 Sediment Sample Collection**

Prior to conducting any on-site activities, START members review and sign the site-specific HASP. The START field team will establish a command post upwind of suspected source areas, if possible. START members will perform calibration checks of air monitoring instruments and document background ambient air monitoring levels. The samplers will decontaminate the sampling equipment. Decontamination will be conducted in accordance with the HASP, applicable SOPs, and/or the Request for Proposal(s) (RFPs) for drilling or excavation services. Decontamination generally consists of an alconox and water wash followed by a distilled water rinse, followed by a de-ionized water final rinse, and air drying. Additionally, where high concentrations of specific substances are anticipated, chemicals such as isopropanol, methanol, hexane, and/or nitric acid may be used in the decontamination process. Equipment decontamination fluids and PPE generated during sampling activities will be containerized and disposed appropriately based on the results of laboratory analyses of samples collected.



### 9.2.1 Sample Collection Procedures for Scoops or Trowels

Collection of surface sediment from beneath shallow water can be accomplished with tools such as scoops or trowels. Surface material can be removed to the required depth; then these tools can be used to collect the sample.

This method can be used to collect consolidated sediments but is limited somewhat by the depth of the water. Accurate, representative sediment samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A stainless steel scoop or trowel should be used. The following section discusses collecting sediment samples for typical analytical parameters under the START Program using scoops or trowels.

VOC Sampling - The proper collection of a sample for VOC (including gasoline-range organics) analysis requires minimal disturbance of the sample to minimize loss of volatile compounds from the sample. Sediment VOC samples will be collected first using a dedicated sampling scoop or trowel and placed directly into the appropriate size, prelabelled glass sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Samples collected for gasoline-range organics analysis by Alaska Method AK101 will be collected following VOC sample collection. The sample should first be collected (with minimal disturbance) into a stainless steel bowl or other appropriate container using a dedicated scoop or spatula. A dedicated coring device (such as a 15 mm syringe with its tip removed) should then be used to transfer a predetermined amount of sediment into a pre-weighed sample container (provided by the laboratory). The approximate weight of sample required is determined by the laboratory and is typically 25 grams. The weight of sample placed in the container will be determined by placing the empty container on a portable electronic scale, zeroing the scale readout, and extruding the sample from the coring device into the container. Practice runs will be performed prior to sampling to determine how far the coring device should be filled to provide the correct amount of sample in a single event. The weight of sample placed in the container will be within +/- 3 grams of the required weight. If the coring device is not suitable because of the sediment type (e.g., fibrous peat or large gravel), the sample will be transferred using a dedicated stainless steel teaspoon. 25-mL aliquots of methanol will be carefully added to the container until the sample is submerged. As the container is pre-weighed at the laboratory, no additional sample labels, tape, or custody seals will be affixed to the sample container. Appropriate sample information will be written on the label affixed to the container by the laboratory.

To increase the data reliability and reproducibility, it is desirable to manually homogenize the sediment sample. After the VOC fraction of sediment is collected,



the remaining sediment sample will be placed into a stainless-steel bowl or other appropriate homogenization container, and mixed thoroughly to obtain a homogenous sample representative of the entire sampling interval. A dedicated sampling scoop or trowel will be used to collect the sample material and place it into the appropriate sample container (preferably a wide-mouth container). Dedicated scoops or trowels are used to prevent the possibility of cross-contamination between sample stations as well as eliminating the need for any decontamination procedures between samples. The container cap will then be secured and the sample will be preserved by immediately placing containers in a cooler with ice.

In cases where split samples will be collected, an adequate amount of sample volume must be homogenized to account for the extra samples. Split samples will be used in situations where confirmation samples will be submitted to an analytical laboratory to verify on-site screening results, or an aliquot is requested by the potentially responsible party (PRP). The following section discusses collecting sediment samples for typical parameters following homogenation of the sample.

Semivolatile Organic Compound (SVOC) Sampling - Sediment samples will be collected using a dedicated sampling scoop or trowel as described above and placed into the appropriate size, prelabelled glass sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Pesticide/Polychlorinated Biphenyl (Pest/PCB) Sampling - Sediment samples will be collected using a dedicated sampling scoop or trowel as described above and placed into the appropriate size, prelabelled glass sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Metals Sampling - Sediment samples will be collected using a dedicated sampling scoop or trowel as described above and placed into the appropriate size, prelabelled sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

Cyanide Sampling - Sediment samples will be collected using a dedicated sampling scoop or trowel as described above and placed into the appropriate size, prelabelled sample container. The samples will then be preserved by placing the sample container in a cooler with ice.

### **9.2.2 Sample Collection Procedures for Auger and Thin-wall Sampling**

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler. The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the sediment to the



completion depth. The auger is then withdrawn and the core collected from the thin-wall tube sampler. This method can be used to collect consolidated sediments, but is somewhat limited by the depth of the water.

Several types of augers are available. These include: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. Posthole augers have limited utility for sample collection, as they are designed more for their ability to cut through fibrous, rooted, swampy areas. The following procedure describes how to collect a sediment sample using an auger:

- Attach the auger bit to a drill extension rod, then attach the "T" handle to the drill extension rod.
- Clear the area to be sampled of any surface debris.
- Insert the assembled auger into the sediment and begin augering, periodically removing accumulated sediment from the auger bucket.
- After reaching the desired depth, the auger is slowly and carefully removed from the boring. When sampling directly from the auger, collect the sample after the auger is removed from boring. Once removed from the bore hole, the top inch of the sample core is removed and discarded. Samples for VOC analysis will be collected first following the procedures described in Section 9.2.1 - Sample Collection Procedures for Scoops or Trowels. For AK101 samples, the coring device should be inserted directly into the auger bucket. The remaining sample will then be placed into a stainless steel bowl (or disposable pan) and homogenized using a dedicated stainless steel scoop or trowel. Any extraneous material not considered to be relevant for analysis is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis (typically SVOC, pest/PCBs, metals, and cyanide) to be performed. The container cap(s) will then be secured and the samples will be preserved by immediately placing the containers in a cooler on ice.

The following procedure describes how to collect a sediment sample using an auger with a thin-wall tube sampler.

- After reaching the desired depth, the auger is slowly and carefully removed the from the boring.



- The auger tip is removed from the drill rod and replaced with a pre-cleaned thin-wall tube sampler and the proper cutting tip is installed.
- The tube sampler is carefully lowered down the borehole, and the tube sampler is gradually forced into the sediment. Care should be taken to avoid scraping the borehole sides.
- The auger is slowly and carefully removed from the boring and the thin-wall tube sampler is removed.
- The top of the core is discarded (approximately 1 inch), as this represents material collected by the tube sampler before penetration of the layer of concern.
- Samples for VOC analysis will be collected first following the procedures described in Section 9.2.1 - Sample Collection Procedures for Scoops or Trowels. For AK101 samples, the coring device should be inserted directly into the sampler. The remaining sample will then be placed into a stainless steel bowl (or disposable pan) and homogenized using a dedicated stainless steel scoop or trowel. Any extraneous material not considered to be relevant for analysis is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis (typically SVOC, pest/PCBs, metals, and cyanide) to be performed. The container cap(s) will then be secured and the samples will be preserved by immediately placing the containers in a cooler on ice.

### **9.2.3 Sample Collection Procedures With an Ekman Dredge**

This technique consists of lowering a sampling device to the sediment by use of a rope, cable, or extended handle. The mechanism is triggered, and the device entraps sediment in spring-loaded jaws, or within lever-operated jaws. The following procedures are used for collecting sediment samples with an Ekman dredge:

- Thread a sturdy nylon or stainless steel cable through the bracket, or secure the extended handle to the bracket with machine bolts.
- Attach springs to both sides. Arrange the Ekman dredge sampler so that the jaws are in the open position and the trip cables are positioned over the release studs.
- Lower the sampler to a point just above the sediment surface.
- Drop the sampler sharply onto the sediment.

- Trigger the jaw release mechanism by lowering a messenger down the line, or by depressing the button on the upper end of the extended handle.
- Raise the sampler and slowly decant any free liquid through the top of the sampler. Be careful to retain fine sediments.
- Open the dredge and transfer the sediment into a stainless steel or plastic bucket. Continue to collect additional sediment until sufficient material has been secured.

Collect samples for VOC analysis first following the procedures described in Section 9.2.1 - Sample Collection Procedures for Scoops or Trowels. For AK101 samples, the coring device should be inserted directly into the dredge. The remaining sample will then be placed into a stainless steel bowl (or disposable pan) and homogenized using a dedicated stainless steel scoop. Any extraneous material not considered to be relevant for analysis is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis (typically SVOC, pest/PCB, metals, and cyanide) to be performed. The container cap(s) will then be secured and the samples will be preserved by immediately placing the containers in a cooler on ice.

#### **9.2.4 Sample Collection Procedures With a Ponar Dredge**

This technique consists of lowering a sampling device to the sediment by use of a rope, cable, or extended handle. A mechanism is triggered, and the device entraps sediment in spring-loaded jaws, or within lever-operated jaws. The following procedures are used for collecting sediment samples with a Ponar dredge.

- Attach a sturdy nylon or steel cable to the hook provided on top of the dredge.
- Arrange the Ponar dredge sampler in the open position, setting the trip bar so the sampler remains open when lifted from the top.
- Slowly lower the sampler to a point just above the sediment.
- Drop the sampler sharply into the sediment, then pull sharply up on the line, thus releasing the trip bar and closing the dredge.
- Raise the sampler to the surface and slowly decant any free liquid through the screens on top of the dredge. Be careful to retain fine sediments.



- Open the dredge and transfer the sediment to a stainless steel or plastic bucket. Continue to collect additional sediment until sufficient material has been gained.

Collect samples for VOC analysis first following the procedures described in Section 9.2.1 - Sample Collection Procedures for Scoops or Trowels. For AK101 samples, the coring device should be inserted directly into the dredge. The remaining sample will then be placed into a stainless steel bowl (or disposable pan) and homogenized using a dedicated stainless steel scoop or trowel. Any extraneous material not considered to be relevant for analysis is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis (typically SVOC, pest/PCB, metals, and cyanide) to be performed. The container cap(s) will then be secured and the samples will be preserved by immediately placing the containers in a cooler on ice.

#### **9.2.5 Sample Collection Procedures With a Sample Coring Device**

The sample coring device consists of a coring device, handle, and acetate core. The following procedures are used for collecting sediment samples with a sample coring device.

- Assemble the coring device by inserting the acetate core into the sampling tube.
- Insert the "eggshell" check valve mechanisms into the tip of the sampling tube with the convex surface positioned inside the acetate core.
- Screw the handle onto the upper end of the sampling tube and add extension rods as needed.
- Place the sampler in a perpendicular position on the material to be sampled.
- This sampler may be used with either a drive hammer for firm consolidated sediments, or a "T" handle for soft sediments. If the "T" handle is used, place downward pressure on the device until the desired depth is reached. Rotate the sampler to shear off the core of the bottom and retrieve the device.
- Slide the acetate core out of the sampler tube. The acetate core may be capped at both ends. The sample may be used in this fashion or samples may be collected for various analytical parameters described in Section 9.2.1 - Sample Collection Procedures for Scoops or Trowels.

Collect samples for VOC analysis first following the procedures described in Section 9.2.1. For AK101 samples, the coring device should be inserted directly into the down-hole end of the acetate core. The remaining sample will then be placed into a stainless steel bowl (or disposable pan) and homogenized using a dedicated stainless steel scoop or trowel. Any extraneous material not considered to be relevant for analysis is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis (typically SVOC, pest/PCB, metals, and cyanide) to be performed. The container cap(s) will then be secured and the samples will be preserved by immediately placing the containers in a cooler on ice.

If the drive hammer is selected, use the following procedures for collecting a sediment sample.

- Insert the tapered handle (drive head) of the drive hammer through the drive head.
- With left hand holding the tube, drive the sampler into the material to the desired depth. Do not drive the tube further than the tip of the hammer's guide.
- Record the length of the tube that penetrated the sample material, and the number of blows required to obtain this depth.
- Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto the drive head. In this position, the hammer serves as a handle for the sampler.
- Rotate the sampler at least two revolutions to shear off the sample at the bottom.
- Lower the sampler handle (hammer) until it just clears the two ear-like protrusions on the drive head, and rotate about 90°.
- Withdraw the sampler by pulling the handle (hammer) upwards and dislodging the hammer from the sampler.
- Slide the acetate core out of the sampler tube. The acetate core may be capped at both ends. The sample may be collected in this fashion or samples may be collected for various analytical parameters described in Section 9.2.1 - Sample Collection Procedures for Scoops or Trowels.



Collect samples for VOC analysis first following the procedures described in Section 9.2.1. For AK101 samples, the coring device should be inserted directly into the down-hole end of the acetate core. The remaining sample will then be placed into a stainless steel bowl (or disposable pan) and homogenized using a dedicated stainless steel scoop or trowel. Any extraneous material not considered to be relevant for analysis is removed from the sample during homogenization and any water present will be decanted. The sample is then placed into the appropriate size, prelabelled sample containers (preferably wide-mouthed) for each analysis (typically SVOC, pest/PCB, metals, and cyanide) to be performed. The container cap(s) will then be secured and the samples will be preserved by immediately placing the containers in a cooler on ice.

## **10.0 Handling and Preservation**

Samples are shipped to analytical laboratories expeditiously to ensure that holding times are not exceeded. A cooler temperature blank, consisting of a small container of tap water, is included in each cooler to monitor the temperature of samples upon receipt at the laboratory. Sediment samples are considered to be properly preserved if they are maintained within the 2 to 6 degree Celcius temperature range. Microbial activity is minimized at these low temperatures, thereby preventing bio-degradation of organic contaminants in the sediment matrix.

Trip blanks are used to assess the degree of contamination introduced into samples during sample handling, shipment, and analysis. Contamination may also be introduced from the use of poorly cleaned non-dedicated sampling equipment, chemical preservatives, sample bottles, or from improper shipping and handling. Samples are shipped to analytical laboratories expeditiously to ensure that holding times are not exceeded. One pair of trip blanks is included in each cooler containing VOC samples.

Chemicals that may be used during the decontamination process may include Alconox detergent, nitric acid, hexane, and isopropanol. Chemical preservatives used during sediment sampling activities are generally limited to those preservatives which are required for aqueous equipment rinsate blanks and trip blanks. Chemical preservatives commonly used to preserve equipment rinsate blanks include hydrochloric acid, nitric acid, and sodium hydroxide. START routinely purchases high-quality certified-clean sampling containers to prevent contamination from sample bottles. Sample jars are also sealed in plastic bags, and carefully placed in coolers lined with absorbent packing material and ice packs to prevent cross-contamination due to breakage of samples during shipment.

## **11.0 Sample Preparation and Analysis**

This section is not applicable to this SOP.



## **12.0 Troubleshooting**

All field screening instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

## **13.0 Data Acquisition, Calculations, and Data Reduction**

### **13.1 Computer Hardware and Software**

Sediment sample locations may be located using a Trimble Pro XRS or GeoExplorer Global Positioning System (GPS) receiver. Prior to conducting field work, Trimble Pathfinder Office 2.51 (Pathfinder software) may be used to generate a data dictionary to be used during collection of sample locations. The data dictionary is then transferred from the computer to the GPS datalogger. Upon returning from the field, GPS data are downloaded from the GPS datalogger to a computer using the Pathfinder software. GPS data undergo differential correction, with base station data obtained from a variety of community base stations depending upon geographic location to improve location accuracy. Pathfinder is used to export GPS data in a variety of formats [i.e. ArcView shapefile, ARC/INFO, dBASE, and AutoCAD export (DXF) files]. Typically, GPS data are exported into dBASE files, and then manipulated withing Microsoft Excel 2000 software. Data are then manipulated where they can be utilized in site diagrams to display sample locations.

### **13.2 Data Management and Records Management**

Field observations made during the sampling event will be recorded in a site logbook and/or field data sheets, including description of sampling locations and any deviations from the site-specific QAPPs. Chain-of-custody will be maintained until samples are relinquished to a courier or to the laboratories assigned to perform the analyses. Photographs will be taken to document site conditions. The location and direction from which photographs are taken will be noted in the field logbook, in accordance with the scope of work. Reports, site file memoranda, figures, tables, boring logs, etc. will be saved in site-specific Technical Direction Document (TDD) directories.

## **14.0 Quality Control and Quality Assurance Section**

This section describes quality assurance/quality control (QA/QC) pertinent to sediment samples, and the types and uses of the QA/QC samples that are collected in the field. QA/QC samples are analyzed to provide information on the variability and usability of environmental sample results. They assist in identifying the origin of analytical discrepancies to help determine how the analytical results should be used. They are used mostly to validate analytical results.

A data quality review of the laboratory sample analyses will be conducted by U.S. EPA.



At a minimum, a Tier I data validation will be conducted, which involves determining data completeness through a data package inventory check. A Tier II data validation is generally completed for Site Assessment projects, and may be done at the specific request of the EPA On-Scene Coordinator for Removal projects. Tier II data validation includes completing a data package inventory, and qualifying the data based on deficiencies in QC sample results. Tier III data validation includes all the elements of a Tier II data validation, plus a check of calculations and evaluation of sample results through an evaluation of the raw data. Deliverables resulting from the data validation process include a data validation memorandum and data tables. Qualifiers are applied to sample results for data packages which go through a Tier II or Tier III data validation, and provide the data user with a sense of the usability and limitations of the data.

Field duplicates (replicates), matrix spike/matrix spike duplicate (MS/MSD), trip blanks, rinsate (equipment) blanks, and temperature blanks are discussed below. QA/QC results may suggest the need for modifying sample collection, preparation, handling, or analytical procedures if the resultant data do not meet quality assurance objectives.

#### **14.1 Field Duplicates**

Field duplicates are used to assess the degree of sample heterogeneity and the reproducibility of the sample collection procedure and the laboratory analysis. Field duplicates are typically collected for sediment samples which are submitted for field screening analysis or for site assessment scoring activities. One field duplicate is typically collected for each matrix type and sample parameter for every 20 stations for Site Assessment projects. The field duplicate is assigned an individual sample number.

#### **14.2 Laboratory Matrix Spike, Matrix Spike Duplicate**

Matrix spike (MS) and matrix spike duplicate (MSD) samples are used to monitor laboratory performance and determine how effectively the analytical method is able to recover target compounds that are spiked into the matrix of interest. MS/MSD samples are spiked by the analyst with a known concentration of a target analytes to monitor recovery of the target compounds. It is necessary to provide extra volume of sample to the laboratory for spiking analyses. Generally, organic parameters (e.g., VOC, SVOC, and Pesticide/PCBs) require triplicate sample volume for MS/MSD analysis. Inorganic analyses typically require MS and laboratory duplicate (Dupl) analyses. Laboratory duplicate precision monitors the laboratory's ability to reproduce its results. Inorganic parameters (e.g., metals and cyanide) require duplicate sample volume. The required frequency for MS/MSD and MS/Dupl analysis is generally one per every 20 samples of each matrix for each requested analytical parameter.

For sediment samples, extra volume is collected, homogenized thoroughly, and sub-sampled by alternately scooping the homogenized sample into two or three separate bottles, as needed. The exception occurs when collecting additional sample volume for VOC MS/MSD analysis,



which are collected prior to homogenization. The MS/MSD samples are assigned the same sample number.

### **14.3 Trip Blanks**

Trip blanks are used to assess the degree of contamination introduced into samples during sample handling, shipment, storage, and analysis. Contamination may be introduced from the sample bottle, the preservatives used, cross-contamination from highly contaminated samples, or from poor shipping and handling procedures experienced both in the field and in the laboratory. Trip blanks are typically collected for VOC analysis. Trip blanks prepared from organic-free water will be collected prior to the sampling event. Each bottle of the trip blank sample will be preserved with one drop of 1:1 HCl per 20 ml of sample to achieve a pH of less than 2. Trip blanks are handled, transported, and analyzed in the same manner as the other samples collected for that analysis. One set of trip blanks is collected for VOC analysis for each cooler in which VOC samples are shipped.

### **14.4 Rinsate (Equipment) Blanks**

Dedicated or decontaminated sampling equipment will be used at each sediment sample location to minimize cross-contamination. Sampling equipment must be decontaminated prior to the start of sampling activities as well as between sample locations, unless the sampling activity is dedicated to one sample location. Rinsate blanks are used to assess contamination (typically, cross-contamination) brought about by improper decontamination procedures between sampling stations. Rinsate blanks are not required for dedicated, disposable sampling implements. Examples of equipment requiring decontamination and rinsate blanks include augers, shovels, Ponar and Ekman Dredge samplers, and non-dedicated stainless steel scoops and bowls.

Rinsate blanks are obtained by pouring analyte-free water over decontaminated sampling equipment to test for residual contamination. The water is collected into the appropriate sample containers which are handled (e.g., preserved), shipped, and analyzed for the same set of analytical parameters as the samples that were collected that day. Where non-dedicated sampling equipment is used, rinsate blanks must be collected at the rate of one per 20 stations for each parameter for which sediment samples are collected.

### **14.5 Temperature Blanks**

Temperature blanks provide information of the preservation (temperature) of the samples during shipment to the laboratories. Temperature blanks are obtained by pouring tap water into a 40-ml glass vial and placing one temperature blank per cooler of samples.



## 15.0 Reference Section

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**STANDARD OPERATING PROCEDURE  
FOR  
SURFACE WATER SAMPLING**

Prepared by:

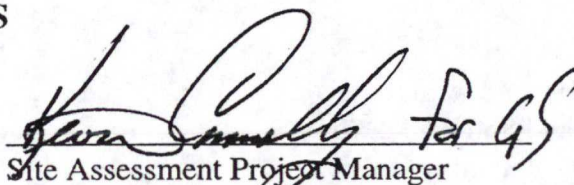
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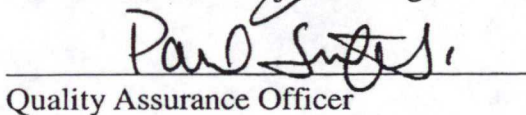
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## 1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for Region X Weston Solutions, Inc. (Weston), Superfund Technical Assessment and Response Team (START) personnel in collecting representative surface water samples. Purposes for the collection and analysis of surface water samples by START personnel and their subsequent analysis will be detailed in site-specific Sampling and Quality Assurance Plans (SQAPs), and may include determining whether concentrations of hazardous substances in surface water samples exceed established action levels, confirming or identifying hazardous substances that may have impacted the environment, determining if contaminants are migrating off site, or if the concentrations of hazardous substances may present a risk to public health, welfare, or the environment.

The methodologies discussed in this procedure are applicable to the sampling of representative liquid samples, both aqueous and non-aqueous, from streams, rivers, lakes, ponds, lagoons, and surface impoundments. This SOP also includes samples collected from depth, as well as samples collected from the surface. These procedures are generic in nature and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, as well as by the constraints presented by the sampling area. However, if modifications occur, they shall be documented in the site logbook or report summarizing field activities.

## 2.0 Summary of Method

Sampling methods and equipment used for collecting aqueous and non-aqueous liquids vary widely, depending upon sampling depth within the water column and the actual matrix of the sample to be collected. Sampling of liquids is generally accomplished through the use of one of the following samplers or techniques: Kemmerer bottle, Bacon Bomb sampler, dip sampler, or direct method.

## 3.0 Acronym List

°C	-	Degrees Celsius
cc	-	Cubic centimeters
CLP	-	Contract Laboratory Program
COC	-	Chain-of-Custody
DAS	-	Delivery of Analytical Services
Dupl	-	Duplicate
DOT	-	Department of Transportation
EPA	-	U.S. Environmental Protection Agency
GPS	-	Global Positioning System
HASP	-	Health and Safety Plan
HCl	-	Hydrochloric Acid
HNO <sub>3</sub>	-	Nitric Acid
IATA	-	International Air Transport Association
IDW	-	Investigation-derived wastes
mg	-	Milligram



ml	-	Milliliters
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate
Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	-	Sodium Thiosulfate
NaOH	-	Sodium Hydroxide
OSHA	-	Occupational Safety and Health Administration
PE	-	Performance Evaluation
pest/PCB	-	Pesticide/Polychlorinated Biphenyl
PFDs	-	Personal Flotation Devices
PPE	-	Personal Protective Equipment
ppm	-	Parts per million
PVC	-	Polyvinyl Chloride
QAPP	-	Quality Assurance Project Plan
QA/QC	-	Quality Assurance/Quality Control
RFP	-	Request for Proposal
SDG	-	Sample Delivery Group
SOP	-	Standard Operating Procedure
SQAP	-	Sampling and Quality Assurance Plan
START	-	Superfund Technical Assessment and Response Team
SVOC	-	Semivolatile Organic Compound
TDD	-	Technical Direction Document
VOA	-	Volatile Organic Analysis
VOC	-	Volatile Organic Compound
Weston	-	Weston Solutions, Inc.

#### 4.0 Health and Safety Warnings

START personnel performing work on hazardous waste sites will follow Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (EPA), and WESTON/START specific health and safety procedures and protocols. START personnel conducting on-site and off-site surface water sampling activities will also be performing tasks in accordance with EPA-approved SQAPs, and Operating Practices prepared and approved by START.

In order to ensure the safety of personnel during sampling activities, the buddy system, periodic air monitoring, and caution will be used throughout field activities. To minimize risks due to chemical exposure, dermal and respiratory protection may be required if air monitoring equipment indicates that the environment is unsafe. Field activities will follow the site health and safety plan (HASP), which further addresses the safety considerations of the property. Hazards identified in or around the site may include physical hazards (slips, trips, and falls). Additional potential physical hazards exist in association with surface water sampling, and may include drowning or exposure due to hypothermia.

When collecting surface water samples from water bodies containing known or suspected hazardous substances, adequate precautions must be taken to ensure the sampler's safety. The START team member collecting the sample should not get too close to the edge of the water where bank failure may cause him or her to lose their balance. The use of personal protective equipment (PPE) and



engineering controls, such as safety nets, shall be specified in the site HASP, and shall be based on site-specific conditions. Appropriate PPE may include lifelines or personal flotation devices (PFDs). If sampling from a vessel is required, appropriate protective measures may be required, and shall be detailed in the site HASP.

The samples collected at the site will be transported to predesignated Contract Laboratory Program (CLP) or Delivery of Analytical Services (DAS) laboratories according to either Department of Transportation (DOT) Hazardous Materials Regulations or International Air Transport Association (IATA) Dangerous Goods Regulations, or hand-delivered to the laboratories. Samples will be transported in a manner that will maintain their integrity, as well as protect against detrimental effects from sample breakage or leakage. Weston's *Manual of Procedures for Shipping and Transporting Dangerous Goods* will be followed whenever samples are shipped.

Decontamination wastes will be collected and secured on site. Separate containers will be used for the aqueous wastes and for flammable, non-chlorinated solvents (methanol and hexane) wastes. Proper personal protection will be worn during decontamination procedures and will include gloves, eye protection, and splash-resistant protective clothing. Off-site disposal of decontamination wastes and contaminated PPE will be conducted through the Subcontract Agreement established by Region X START for disposal of investigation-derived wastes (IDW). Non-contaminated wastes will be tightly sealed, double-bagged, and disposed of appropriately.

## **5.0 Interferences**

Some interferences or potential problems associated with surface water sampling include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve the use of contaminated equipment, disturbance of bottom sediments resulting in the entrainment of sediment fines in the surface water sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

## **6.0 Personnel Qualifications**

Training of START members will be provided to ensure that technical, operational, and quality requirements are understood. START personnel are trained in-house to conduct surface water sampling activities. Prior to sampling from a vessel, the WESTON Operating Procedures relevant to the Operation and Use of Boats shall be reviewed. Training includes reviewing this SOP and other applicable SOPs and/or guidance documents; health and safety training; "hands-on" experience conducting sampling activities with more experienced START personnel, and with performing instrument calibrations.

## 7.0 Apparatus and Materials

Equipment/materials for collecting surface water samples includes, but is not limited to the following:

- Site-specific SQAP.
- Standard Operating Procedure for Surface Water Sampling.
- Safety equipment specified in the site HASP.
- Field map of site.
- Logbook.
- Waterproof pen.
- Field data sheets (e.g. sample description sheets, etc.).
- Tape measure.
- Compass.
- Survey stakes, flags (white), and buoys and anchors.
- Camera and film.
- Kemmerer bottles.
- Bacon bomb sampler.
- Dip sampler.
- Line and messengers.
- Sampling jars.
- Preservatives.
- Safety equipment.
- Decontamination fluids (supplies)/equipment (pump sprayers, brushes, etc.).
- Plastic sheeting (Visqueen).
- Sealable plastic bags.
- Bottle labels.
- Chain-of-custody forms and seals.
- Coolers and ice.
- Vermiculite.
- Strapping tape.

## 7.1 Reagents

Reagents used for the preservation of surface water samples include hydrochloric acid (HCl), nitric acid (HNO<sub>3</sub>), sodium hydroxide (NaOH), sodium sulfite, and ascorbic acid. HCl, HNO<sub>3</sub>, and NaOH are used to preserve surface water samples collected in the field for volatile organic compound (VOC), metals, and cyanide analyses, respectively. It is not expected that surface water samples will contain free (residual) chlorine unless they are treated effluent samples or are collected near the outfall of a treated water effluent. If chlorination is suspected, the water will be tested for free chlorine using chlorine test strips according to the manufacturer's directions. If samples are collected for VOC, semivolatile organic compound (SVOC), or cyanide analyses, samples that test positive for residual chlorine will require treatment with a reducing agent before sample preservation. Ascorbic



acid is used as a reducing agent for samples collected for VOC and cyanide analyses, and sodium sulfite is used as a reducing agent for samples collected for SVOC analysis. Samples collected for oil analysis may sometimes be preserved with HCl or sulfuric acid to prevent degradation by microbial action.

Reagents used for decontamination of sampling equipment are discussed in *Section 4.0, Health and Safety Warnings*. Non-aqueous samples are typically not preserved due to the uncertain nature of the matrix, which may evolve harmful gases upon addition of acid or base to the sample.

## **8.0 Method Calibration**

This section is not applicable to this SOP.

## **9.0 Sample Collection**

Under the Removal Program, surface water samples may be collected to determine if any hazardous substances are present on site at such concentrations that a removal action is warranted or if contaminants from on-site sources are migrating off site. Under the Site Assessment Program, surface water samples are generally collected to determine if concentrations of hazardous substances document an observed release to the surface water pathway and can be used to document actual contamination to drinking water supplies (surface water intakes), fisheries (food chain), and/or sensitive environments (wetlands, Clean Water Act-protected bodies, endangered and/threatened species, etc.) under the Hazard Ranking System.

In order to collect a representative sample, the hydrology and morphometrics (e.g., measurements of volume, depth, etc.) of a stream or impoundment should be determined prior to sampling. This will aid in determining the presence of phases or layers in lagoons or impoundments, flow patterns in streams, and appropriate sample locations and depths.

Water quality data should be collected in impoundments to determine if stratification is present. Measurements of dissolved oxygen, pH, and temperature can indicate if stratification exists which would affect analytical results. Measurements should be collected at 3-foot intervals from the substrate to the surface using an appropriate instrument, such as a Hydrolab (or equivalent).

Water quality measurements such as dissolved oxygen, pH, temperature, conductivity, and oxidation-reduction potential can assist in the interpretation of analytical data and the selection of sampling sites and depths any time surface water samples are collected.

Factors in the selection of a sampling device for sampling liquids in streams, rivers, lakes, ponds, lagoons, and surface impoundments include whether the sample is to be collected from the shore or from a boat, the desired depth from which the sample is to be collected, and the overall depth and flow direction of river or stream.



The appropriate sampling device must be of a proper composition. Samplers constructed of glass, stainless steel, or Teflon should be used based upon the analyses to be performed.

### **9.1 Presampling Preparation**

Following EPA approval of the site-specific SQAPs, and prior to conducting sampling activities, a pre-sampling meeting will be held by START team members to discuss the proposed sampling strategy and site health and safety issues. Attendees of the pre-sampling meeting will include the Project Manager, Site Leader, samplers, and the START Health and Safety Officer. During the pre-sampling meeting, the Site Leader will discuss the site history, contaminants of concern, sampling methodology, individual responsibilities, sample shipment or delivery, health and safety issues, and lines of communication anticipated during the sampling event.

Prior to mobilizing to the site to conduct sampling activities, the START Site Leader will fill out an equipment/supply list and transmit the list to the WESTON Equipment Stores technician one week prior to the sampling event. Necessary sampling equipment, sample containers, PPE, and vehicles are therefore reserved. Analytical services are procured for water samples through CLP or subcontract DAS laboratories at least one week prior to the sampling event by START analytical staff members under the supervision of the START Lead Chemist.

### **9.2 Surface Water Sample Collection**

Prior to conducting any on-site activities, START members review and sign the site-specific HASP. The START field team will establish a command post upwind of suspected source areas, if possible. START members will perform calibration checks of air monitoring instruments and document background ambient air monitoring levels. The samplers will decontaminate the sampling equipment. Decontamination will be conducted in accordance with the HASP, and/or applicable SOPs. Decontamination generally consists of an alconox and water wash followed by a distilled water rinse, followed by an isopropanol rinse, followed by a de-ionized water final rinse, and air drying. Additionally, where high concentrations of specific substances are anticipated, chemicals such as methanol, hexane, and/or HNO<sub>3</sub> may be used in the decontamination process. Equipment decontamination fluids and PPE generated during sampling activities will be containerized and disposed appropriately based on the results of laboratory analyses of samples collected.

The number of samples and the locations of surface water samples to be collected will be detailed in the site-specific SQAP. For streams, rivers, lakes, and other surface waters, a direct sampling method may be utilized to collect the samples. This method is not to be used for sampling lagoons or other impoundments where contact with contaminants is a concern. The direct method may also be used when collecting samples from outfall pipes where effluent flow is sufficiently low to avoid exposure from splashing. A dipper with a long handle may be used to collect surface water samples from outfall pipes, lagoon banks, or any



other location where direct access is limited. The long handle allows access from a safe, discrete location.

It is not expected that surface water samples will contain free (residual) chlorine unless they are treated effluent samples or are collected near the outfall of a treated water effluent. If chlorination is suspected, the water will be tested for free chlorine using chlorine test strips according to the manufacturer's directions. When collecting samples for VOC, SVOC, or cyanide analyses, samples that test positive for residual chlorine will require treatment with a reducing agent before sample preservation. These procedures are discussed in the following sections.

### **9.2.1 Sample Collection Procedures for Direct Surface Water Sampling**

The sampling station will be accessed by appropriate means. For shallow stream stations, the sample will be collected by placing the appropriate sample container under the water surface, pointing the container upstream. The container must be upstream of the collector. The sampler(s) will avoid disturbing the substrate. For lakes and other impoundments, the sample will be collected under the water surface avoiding surface debris, any boat wakes, and contact with the sampler's gloves. When collecting samples from several stations along a stream, always begin collecting samples from downstream to upstream locations.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of the preservative necessary for proper sample preservation.

Surface water samples suspected of containing chlorine (for example, samples collected downstream of a wastewater treatment plant) must be tested for residual chlorine before the samples are placed into containers and preserved. To test for chlorine, use potassium-iodide paper dipped in a volatile organic analysis (VOA) vial containing 2 to 5 milliliters (ml) of the sample. A blue coloration on the wet paper indicates the presence of residual chlorine. The potassium-iodide paper should be kept away from light during storage. Samples that test positive for residual chlorine must be pre-treated with either sodium thiosulfate ( $\text{Na}_2\text{S}_2\text{O}_3$ ) or ascorbic acid. [Note: Samples are only to be treated using  $\text{Na}_2\text{S}_2\text{O}_3$  or ascorbic acid if the samples test positive]. Add 0.008% (a few crystals) of  $\text{Na}_2\text{S}_2\text{O}_3$  to an empty VOA vial. Add the sample to the VOA vial, and preserve as directed in the section below. The sample aliquot submitted for cyanide analysis must be pre-treated with 0.6 grams of ascorbic acid per liter of sample. The following section discusses collecting surface water samples for typical analytical parameters under the START Program.

**VOC Sampling** - The proper collection of a sample for VOC analysis requires minimal disturbance of the sample to limit volatilization, and therefore prevent loss of volatile compounds from the sample. VOC samples shall not be collected and/or



preserved near a running motor or any type of exhaust system due to possible contamination by discharges, fumes, or vapors.

If the sample tests positive for residual chlorine, it must be treated with  $\text{Na}_2\text{S}_2\text{O}_3$  prior to pH adjustment using HCl preservative. Each sample container will be filled to just overflowing (forming a convex meniscus) in such a manner that no air bubbles pass through the sample as the bottle is being filled. Care will be taken to avoid flushing the ascorbic acid from the sample container.

The pH of the sample will be adjusted to  $< 2$  by carefully adding the appropriate number drops of 1:1 HCl. Generally one drop of 1:1 HCl for each 20 ml of sample volume is adequate; however, some samples collected in the field have different buffering capacities and may require additional drops of HCl to achieve a pH of  $< 2$ . Alternately, the sample containers can be pre-preserved with HCl and the sample carefully filled to just overflowing to avoid washing out the preservative.

The sample container is then sealed so that no air bubbles are entrapped. The sealed bottle will be inverted, tapped gently on the side, and observed for 10 seconds for the presence of air bubbles. If an air bubble larger than 0.25-inches appears, the sample will be discarded and the collection procedure repeated. The sample containers will then be shaken vigorously to mix the preservative; placed in a sealable plastic bag; and placed into a cooler with ice.

Samples should be shipped or delivered to the laboratory daily so as not to exceed the holding time. Ensure that the samples remain at 4 degrees Celsius ( $^{\circ}\text{C}$ ), but do not allow them to freeze.

One trip blank sample (organic-free water) will be collected prior to the sampling event. Preparation of trip blanks is discussed in *Section 14.3, Trip Blanks*.

SVOC Sampling - Samples will be collected as described above into appropriate size glass containers. CLP does not specify addition of preservative. The container cap(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice. Samples will be shipped to the laboratory in an expeditious manner so as not to exceed the holding time.

Pesticides (pest)/polychlorinated biphenyls (PCBs) Sampling - Samples will be collected as described above into appropriate size glass containers. The container cap(s) will then be secured and the samples will be preserved by immediately placing the containers in a cooler on ice.

Metals Sampling - Samples will be collected as described above into appropriate size plastic or glass containers and preserved with  $\text{HNO}_3$  to a pH of  $< 2$ . The container



cap(s) will then be secured; and the samples will be preserved by immediately placing the containers in a cooler on ice.

Cyanide (Total and Amenable) Sampling - Samples will be collected as described above into the appropriate glass or plastic containers to which 0.6 gm of ascorbic acid has been added. Care will be taken to avoid flushing the ascorbic acid from the sample container. The samples will then be preserved with NaOH to a pH of > 12. The container cap(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice.

pH Sampling - Samples will be collected as described above into glass or plastic containers. The container cap(s) will then be secured, and the samples will be preserved by immediately placing the containers in a cooler on ice. Samples collected for pH analysis will be tested in the field and must be transported to a laboratory for analysis as soon as possible after collection. A field pH may be determined by touching a piece of pH paper to a drop of sample in the cap or around the lip of the sample container. The field pH should then be recorded on the Chain-of-Custody (COC) record.

Oil Identification Sampling - It is recommended that wherever possible, liquid samples for this parameter be collected directly into the appropriate glass container that is shipped to the laboratory for analysis. Since oil tends to adhere to the walls of the container or samplers, results may be biased low when oil in the sample clings to the surfaces of the sampling device upon transfer of the liquid into the sample bottle. Oil can also be degraded by microbial action, and therefore must be preserved with HCl or sulfuric acid to a pH of < 2, and then placed in a cooler with ice. If an oil layer is present on top of the water surface, a representative amount of the oil should be collected with the sample.

### **9.2.2 Sample Collection Procedures for Dipper Sampling**

The dipper device is assembled by fastening a new wide-mouth glass sampling container to a long handle. The device is then extended to the sample location, and the sample collected by allowing the material to flow into the sample container. When the sample container is full, the dipper device is retrieved and the material transferred into the appropriate, pre-labeled sample container(s). Collect samples for VOC analysis first, followed by SVOC, pest/PCB, metals, and cyanide following the procedures described in Section 9.3.1 - *Sample Collection Procedures for Direct Surface Water Sampling*. When using the dipper method, one wide-mouthed glass sampling container is dedicated to each sampling station to avoid the cross-contamination of samples.



### 9.2.3 Sample Collection Procedures Using a Kemmerer Bottle

The Kemmerer bottle may be used in most situations where site access is from a boat or structure such as a bridge or pier, and where samples at depth are required. Sampling procedures are as follows:

- Using a properly decontaminated Kemmerer bottle, set the sampling device so that the sampling end pieces are pulled away from the sampling tube, allowing the substance to be sampled to pass through this tube.
- Lower the preset sampling device to the predetermined depth. Avoid bottom disturbance.
- When the Kemmerer bottle is at the required depth, send down the messenger, closing the sampling device.
- Retrieve the sampler and discharge the first 10 to 20 ml to clear any potential contamination on the valve. Collect samples for VOC analysis first, followed by SVOC, pest/PCB, metals, and cyanide following the procedures described in Section 9.3.1 - *Sample Collection Procedures for Direct Surface Water Sampling*.

### 9.2.4 Sample Collection Procedures Using a Bacon Bomb Sampler

A Bacon Bomb sampler may be used in similar situations to those outlined for the Kemmerer bottle. Sampling procedures are as follows:

- Lower the Bacon Bomb sampler carefully to the desired depth, allowing the line for the trigger to remain slack at all times. When the desired depth is reached, pull the trigger line until taut.
- Release the trigger line and retrieve the sampler.
- Transfer the sample to the appropriate sample container by pulling the trigger. Collect samples for VOC analysis first, followed by SVOC, pest/PCB, metals, and cyanide following the procedures described in Section 9.3.1 - *Sample Collection Procedures for Direct Surface Water Sampling*.

## 10.0 Handling and Preservation

Trip blanks are used to assess the degree of VOC contamination introduced into samples during sample handling, shipment, storage, and analysis. One pair of trip blanks is included in each cooler containing VOC samples. Trip blank samples prepared from organic-free water will be collected in 40-ml VOA vials prior to the sampling event. The glass sample container(s) used for the trip blanks



will be from the same lot as the corresponding sample vials. Each bottle of the trip blank sample will be preserved with one drop of 1:1 HCl per 20 ml of sample. The trip blank sample will be handled in the same fashion as the samples collected in the field, labeled, placed into a sealable plastic bag, transported to the field with the empty sample containers, and shipped to the laboratory in the same cooler as the VOC field samples.

Contamination may also be introduced from the use of poorly cleaned non-dedicated sampling equipment, chemical preservatives, sample bottles, or from improper shipping and handling. Chemicals that may be used during the decontamination process include Alconox detergent,  $\text{HNO}_3$ , hexane, and isopropanol. Chemical preservatives commonly used to preserve aqueous samples and equipment rinsate blanks include HCl,  $\text{HNO}_3$ , NaOH, and sulfuric acid. START routinely purchases high-quality certified-clean sampling containers to prevent contamination from sample bottles. Sample jars are also sealed in plastic bags and/or sleeve-protectors to avoid bottle breakage and provide containment in the event that a bottle is broken in shipment. The samples are carefully placed in coolers lined with absorbent packing material and ice packs, to avoid cross-contamination due to breakage of samples during shipment.

Samples are shipped to analytical laboratories expeditiously to ensure that holding times are not exceeded. A cooler temperature blank, consisting of a small container of tap water, is included in each cooler to monitor the temperature of samples upon receipt at the laboratory. Samples are considered to be properly preserved if they are maintained within the 2 to 6 °C temperature range. Microbial activity is minimized at these low temperatures, thereby preventing biodegradation of organic contaminants in the sample matrix.

## **11.0 Sample Preparation and Analysis**

This section is not applicable to this SOP.

## **12.0 Troubleshooting**

All field screening instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

## **13.0 Data Acquisition, Calculations, and Data Reduction**

### **13.1 Computer Hardware and Software**

Surface water sample locations may be located using a Trimble Pro XRS or GeoExplorer Global Positioning System (GPS) receiver. Prior to conducting field work, Trimble Pathfinder Office 2.51 (Pathfinder software) may be used to generate a data dictionary to be used during collection of sample locations. The data dictionary is then transferred from the computer to the GPS datalogger. Upon returning from the field, GPS data are downloaded from the GPS datalogger to a computer using the Pathfinder software. GPS data undergo



differential correction, with base station data obtained from a variety of community base stations depending upon geographic location to improve location accuracy. Pathfinder is used to export GPS data in a variety of formats [i.e. ArcView shapefile, ARC/INFO, dBASE, and AutoCAD export (DXF) files]. Typically, GPS data are exported into dBASE files, and then manipulated within Microsoft Excel 2000 software. Data are then manipulated where they can be utilized in site diagrams to display sample locations.

### **13.2 Data Management and Records Management**

Field observations made during the sampling event will be recorded in a site logbook and/or field data sheets, including description of sampling locations and any deviations from the site-specific SQAPs. COC will be maintained until samples are relinquished to a courier or to the laboratories assigned to perform the analyses. Photographs will be taken to document site conditions. The location and direction from which photographs are taken will be noted in the field logbook, in accordance with the scope of work. Reports, site file memoranda, figures, tables, boring logs, etc. will be saved in site-specific Technical Direction Document (TDD) directories.

### **14.0 Quality Assurance and Quality Control Section**

This section describes quality control/quality assurance (QA/QC) pertinent to surface water samples, and the types and uses of the QA/QC samples that are collected in the field. QA/QC samples are analyzed to provide information on the variability and usability of environmental sample results. They assist in identifying the origin of analytical discrepancies to help determine how the analytical results should be used. They are used mostly to validate analytical results.

A data quality review of the laboratory sample analyses will be conducted by U.S. EPA. At a minimum, a Tier I data validation will be conducted, which involves determining data completeness through a data package inventory check. A Tier II data validation is generally completed for Site Assessment projects, and may be done at the specific request of the EPA On-Scene Coordinator for Removal projects. Tier II data validation includes completing a data package inventory, and qualifying the data based on deficiencies in QC sample results. Tier III data validation includes all the elements of a Tier II data validation, plus a check of calculations and an evaluation of sample results through an evaluation of the raw data. Deliverables resulting from the data validation process include a data validation memorandum and data tables. Qualifiers are applied to sample results for data packages which go through a Tier II or Tier III data validation, and provide the data user with a sense of the usability and limitations of the data.

Field duplicates, matrix spike/matrix spike duplicate (MS/MSD), laboratory duplicates (Dupl), trip blanks, rinsate (equipment) blanks, PE, and temperature blanks are discussed below. QA/QC results may suggest the need for modifying sample collection, preparation, handling, or analytical procedures if the resultant data do not meet QA objectives.



#### **14.1 Field Duplicates**

Field duplicates are used to assess the degree of sample heterogeneity and the reproducibility of the sample collection procedure and the laboratory analysis. Field duplicates are typically collected for surface water samples which are submitted for field screening analysis or for Site Assessment scoring activities. One field duplicate is typically collected for each matrix type and sample parameter for every 20 stations for Site Assessment projects. The field duplicate is assigned an individual sample number.

#### **14.2 Laboratory Matrix Spike, Matrix Spike Duplicate, and Duplicate**

MS and MSD samples are used to monitor laboratory performance and determine how effectively the analytical method is able to recover target compounds that are spiked into the matrix of interest. MS/MSD samples are spiked by the analyst with a known concentration of a target analytes to monitor recovery of the target compounds. It is necessary to provide extra volume of sample to the laboratory for spiking analyses. Generally, organic parameters (e.g., VOC, SVOC, and pest/PCBs) require triplicate sample volume for MS/MSD analysis. Inorganic analyses typically require MS and laboratory Dupl analyses. Laboratory duplicate precision monitors the laboratory's ability to reproduce its results. Inorganic parameters (e.g., metals and cyanide) require duplicate sample volume. The required frequency for MS/MSD and MS/Dupl analysis is generally one per every 20 samples of each matrix for each requested analytical parameter. Extra volume for the pre-designated QC sample must be provided to the laboratory for MS/MSD and MS/Dupl analyses. The QC sample, its MS/MSD, and MS/Dupl all receive the same sample number.

#### **14.3 Trip Blanks**

Trip blanks are used to assess the degree of contamination introduced into samples during sample handling, shipment, storage, and analysis. Contamination may be introduced from the sample bottle, the preservatives used, cross-contamination from highly contaminated samples, or from poor shipping and handling procedures experienced both in the field and in the laboratory. Trip blanks are typically collected for VOC analysis. Trip blanks prepared from organic-free water will be collected prior to the sampling event. Each bottle of the trip blank sample will be preserved with one drop of 1:1 HCl per 20 ml of sample to achieve a pH of < 2. Trip blanks are handled, transported, and analyzed in the same manner as the other samples collected for that analysis. One set of trip blanks is collected for VOC analysis for each cooler in which VOC samples are shipped.

#### **14.4 Rinsate (Equipment) Blanks**

Dedicated or decontaminated sampling equipment will be used at each surface water sample location to minimize cross-contamination. Sampling equipment must be decontaminated prior to the start of sampling activities as well as between sample locations, unless the sampling activity is dedicated to one sample location. Rinsate blanks are used to assess



contamination (typically, cross-contamination) brought about by improper decontamination procedures between sampling stations. Rinsate blanks are not required for dedicated, disposable sampling implements. Examples of equipment requiring decontamination and rinsate blanks include Kemmerer samplers and Bacon Bomb samplers.

Rinsate blanks are obtained by pouring analyte-free water over decontaminated sampling equipment to test for residual contamination. The water is collected into the appropriate sample containers which are handled (e.g., preserved), shipped, and analyzed for the same set of analytical parameters as the samples that were collected that day. Where non-dedicated sampling equipment is used, rinsate blanks must be collected at the rate of one per 20 stations for each parameter for which surface water samples are collected.

#### **14.5 Temperature Blanks**

Temperature blanks provide information on the preservation (temperature) of the samples during shipment to the laboratories. Temperature blanks are obtained by pouring tap water into a 40-ml glass vial and placing one temperature blank per cooler of samples.

#### **15.0 Reference Section**

Weston Solutions, Inc. December 1999. *Manual of Procedures for Shipping and Transporting Dangerous Goods*.

Trimble Navigation Limited, 1999, *TSC1 Asset Surveyor*, Operation Manual, Version 5.00, Revision A, Sunnyvale, CA.

Trimble Navigation Limited, 1999, *TSC1 Asset Surveyor*, Software User's Guide, Version 5.00, Revision A, Sunnyvale, CA.

Trimble Navigation Limited, 1996-1999, *Pathfinder Software*, Version 2.51, Sunnyvale, CA.

U.S. Environmental Protection Agency. June 2001. *Contract Laboratory Program (CLP) Guidance for Field Samplers*. Draft Final. Office of Emergency and Remedial Response, Washington, D.C. OSWER Directive 9240.0-35. EPA/540-R-00-003.

U.S. Environmental Protection Agency. 2000. *U.S. EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration*. Document Number ILM04.1.

U.S. Environmental Protection Agency. 1999. *US EPA Contract Laboratory Program Statement Of Work For Organics Analysis, Multi-Media, Multi-Concentration*. Document Number OLM04.2.



U.S. Environmental Protection Agency. February 1998. *EPA Guidance for Quality Assurance Project Plans*. Office of Research and Development, Washington, D.C. EPA/600/R-98/018. OSWER Directive 9360.4-01.

U.S. Environmental Protection Agency. 1998. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846*. 3rd Edition, Revision 5.

U.S. Environmental Protection Agency. November 1991. *Removal Program Representative Sampling Guidance, Volume 1: Soil*. Office of Emergency Remedial Response, Washington, D.C. OSWER Directive 9630.4-10.

U.S. Environmental Protection Agency. January 1991. *Compendium of ERT Soil Sampling and Surface Geophysics Procedures* Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9360.4-02. EPA/540/P-91/006.

**APPENDIX B**  
**SUPPLEMENTAL FORMS**





## SURFACE SOIL/SEDIMENT FIELD SAMPLING RECORD

Project Number: _____	Sampling Personnel: _____
Date: _____	Weather: _____
Location Description: _____	
Uncorrected GPS Coordinates: _____	
Corrected GPS Coordinates: _____	
GPS File Name: _____	Sampling Method: _____
WESTON Sample No.: _____	Water Depth to Sediment: _____
EPA Sample No.: _____	Photograph: roll: _____ exposure: _____
Analyses: _____	

Grab #	Time	Penetration Depth	Sample Material Physical Description [Grain Size (% gravel/sand/silt/clay), Color, Odor, Slag, Organics, Debris, Etc.]

Notes: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Sampler's Signature: \_\_\_\_\_



## SURFACE WATER FIELD SAMPLING RECORD

Project Name: _____	Sampling Personnel: _____
Project Location: _____	Project Number: _____
Date: _____	Weather: _____

Sampling Point Number: \_\_\_\_\_ Time: \_\_\_\_\_ Depth to Sampling Point: \_\_\_\_\_

Location Description: \_\_\_\_\_ Coordinates: \_\_\_\_\_

Access Method: \_\_\_\_\_ Sampling Method: \_\_\_\_\_

Description of Sample (color, turbidity, odor): \_\_\_\_\_

WESTON Sample ID: \_\_\_\_\_

EPA Sample Number: \_\_\_\_\_

<u>Sample Container(s)</u>	<u>Quantity</u>	<u>Analysis</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Sampling Point Number: \_\_\_\_\_ Time: \_\_\_\_\_ Depth to Sampling Point: \_\_\_\_\_

Location Description: \_\_\_\_\_ Coordinates: \_\_\_\_\_

Access Method: \_\_\_\_\_ Sampling Method: \_\_\_\_\_

Description of Sample (color, turbidity, odor): \_\_\_\_\_

WESTON Sample ID: \_\_\_\_\_

EPA Sample Number: \_\_\_\_\_

<u>Sample Container(s)</u>	<u>Quantity</u>	<u>Analysis</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Notes: \_\_\_\_\_

Sampler's Signature: \_\_\_\_\_





## SAMPLE PLAN ALTERATION FORM

Project Name and Number: \_\_\_\_\_

Material to be sampled: \_\_\_\_\_

Measurement Parameter: \_\_\_\_\_

Standard Procedure for Field collection and Laboratory Analysis (cite references):

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Reason for change in Field Procedure or Analytical Variance:

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Variance from Field or Analytical Procedure:

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Special Equipment, Materials, or Personnel Required:

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Initiators Name: \_\_\_\_\_ Date: \_\_\_\_\_

Project Approval: \_\_\_\_\_ Date: \_\_\_\_\_

QA Officer/Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

**APPENDIX C**

**SAMPLE DOCUMENTATION AND CHAIN-OF-CUSTODY FORMS**



### FIELD SAMPLE DATA AND CHAIN OF CUSTODY SHEET

EPA Region 10  
1200 Sixth Avenue  
Seattle WA 98101

**Case No.:**

☐ Enforcement/Custody

Miscellaneous:

Sampling Crew:

Project Code:

Account:

☐ Data Confidential☐ Possible Toxic/Hazardous

Name/Location

(EPA Lab Only. Leave Blank for Contract Lab)

☐ Data for STORET

Proj. Off.:

Tel.#

Recorder:

Recorder, \_\_\_\_\_  
(Signatures Required)

[illegible][illegible]

Laboratory Copy

White

Project Officer Copy

Yellow

Field or Office Copy

Pin

Project Name: \_\_\_\_\_ Project Code: \_\_\_\_\_ Account Code: \_\_\_\_\_

**Matrix Codes** (circle one only)

- 10 Water - Total  
11 Water - Dissolved  
17 Liquid for TCLP  
40 Sediment/Soil  
45 Semi-Solid/Sludge  
47 Sediment for TCLP  
70 Tissue  
80 Oil/Solvent  
00 Other - see reverse

### Sample Numbers

[illegible][illegible]

Check the Work Group (see reverse for additional WG's) and/or specific metals below for each sample (please be sure metals checked coincide with those identified in the sampling and analysis plan).

**Workgroups (WG):**

WG 19	CLP In. Anal.
WG 32	Metals - DW-RCRA

Analy/Comp
Init/Date

### Specific Metals:

Aluminum	Al
Antimony	Sb
Arsenic	As
Barium	Ba
Beryllium	Be
Cadmium	Cd
Calcium	Ca
Chromium	Cr
Cobalt	Co
Copper	Cu
Iron	Fe
Lead	Pb
Magnesium	Mg
Manganese	Mn
Mercury	Hg
Molybdenum	Mo
Nickel	Ni
Potassium	K
Selenium	Se
Silver	Ag
Sodium	Na
Thallium	Tl
Vanadium	V
Zinc	Zn
*Hexavalent Chromium	Cr+6

This image shows a full page of blank graph paper. The grid consists of small squares formed by thin black lines. There are approximately 20 columns and 25 rows of squares. A thicker vertical line runs down the left side, creating a margin. A thicker horizontal line runs across the top, creating a header space. The rest of the page is filled with the standard grid pattern.

\*The Laboratory requires advance notice prior to receiving samples for Cr+6

Save samples after analysis? **NONE** **SOME\*\*** **ALL\*\*** (if **SOME**, circle sample numbers)

**Special limits, methods and comments:**

**Requester's Signature**

Date \_\_\_\_\_

**\*\*If samples should be saved, why?**

**Note:** Any element may be determined by AA or ICP.